EXHIBIT B

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
TYLER DIVISION

Network-1 Technologies, Inc., Plaintiff, v. Alcatel-Lucent USA Inc., *et al.*, Defendants.	Case No. 6:11-cv-00492-RWS-KNM Jury Trial Demanded Lead Consolidated Case

DECLARATION OF DEAN P. NEIKIRK, PH.D REGARDING CLAIM CONSTRUCTION FOR U.S. PATENT NO. 6,218,930

I, Dean P. Neikirk, hereby declare as follows:

1. I am presently of professor of electrical and computer engineering at the University of Texas at Austin. My titles are Professor, Cullen Trust for Higher Education Endowed Professorship in Engineering (No. 7) at the Cockrell School of Engineering, and Associate Dean of Graduate Studies.

2. I have prepared this declaration on behalf of Defendants Alcatel-Lucent USA Inc., Alcatel-Lucent Holdings Inc., Avaya Inc., Axis Communications AB, Axis Communications, Inc., Dell Inc., Hewlett-Packard Company, Juniper Networks, Inc., Polycom, Inc., ShoreTel, Inc., Sony Corporation, Sony Corporation of America, and Sony Electronics Inc. (collectively, "Defendants") in connection with the district court litigation captioned *Network-1 Technologies, Inc. v. Alcatel-Lucent USA Inc., et al.*, No. 6:11-cv-492 (E.D. Tex.).

3. I have no personal interest, financial or otherwise, in the outcome of the present litigation. The opinions set forth in this declaration are my opinions, and are not influenced by my compensation in this matter.

I. BACKGROUND AND QUALIFICATIONS

A. Education

4. I received a Bachelor of Science degree from Oklahoma State University, in physics and mathematics, in 1979.

5. Following my undergraduate studies, I attended the California Institute of Technology, where I earned a Master's degree and Doctorate degree in applied physics, in 1981 and 1984 respectively.

6. Each of my academic degrees involved significant studies in solid state physics, semiconductor devices, electrical engineering, and electronics. For example, courses relating to

these fields that I took include two years of study in electromagnetics, one year of study in solid state and semiconductor physics, as well as four years of graduate research in electronic devices.

B. Research and Teaching Experience

7. My work as a professor began in 1984, when I joined the University of Texas at Austin as an assistant professor. In 1988 I became an associate professor, and in 1992 became a full professor. Today, I continue to be a full professor at the University of Texas.

8. Over the years, I have taught a variety of electrical engineering courses at the University. These include Integrated Circuit Fabrication, VLSI Fabrication Techniques, Electromagnetics in Packaging, Simulation Methods in CAD/VLSI, Micro-Electromechanical Systems, and Electromagnetic Engineering. I have also taught several continuing education courses in these fields.

9. My research areas include the fabrication and modeling of electromagnetic micro-machined sensors and actuators. I am also involved in research relating to integrated circuit processing and the high frequency properties of transmission lines. Over the years, I conducted research in the area of wireless sensors for identifying failing bridges and improving the safety of new bridges. I have also conducted research in the areas of electromagnetics and acoustics, manufacturing systems engineering, and solid-state electronics. I am presently a member of the University's Microelectronics Research Center.

10. I have also devoted a significant portion of my time at the University to contributing to various technical journals and other publications. My work has been included in more than 90 refereed archival journal publications, 165 refereed conference proceedings, and 24 published abstracts. I have also contributed to book chapters and technical reports relating to various electrical engineering topics. My publications have addressed technologies such as integrated circuits for antenna arrays, thermocouples for far-infrared detection, multilayer

interconnection lines for high speed digital integrated circuits, oscillator circuits, diode circuits, and infrared detection circuits. In addition, I have been invited to speak at various lectures and professional society presentations addressing similar topics in electrical engineering.

11. More information on my research and teaching experience, and my contribution to technical publications, is included in my curriculum vitae.

C. Industry Experience

12. While the majority of my professional experience in electrical engineering has involved research and teaching, I have also provided technical consulting to numerous companies and been involved in academic-industry partnerships. For example, I have provided consulting to Teltech Resource Network, Ardex, Inc., E.P. Hamilton Associates, Burnett Company, Microelectronics and Computer Technology Corporation, and Baker-Hughes. In addition, my work on electro-chemical sensors was selected as a commercialization venture between the University and LabNow, Inc. Further, my work together with a graduate student relating to actuator stacked microbolometer arrays for multispectral infrared detection was selected for sponsorship by Coventor, Inc., a company that provides software tools for developing microelectromechanical systems, microfluidics, and semiconductor process applications.

D. Professional Society Involvement

13. I have been a Senior Member of the Institute of Electrical and Electronics Engineers ("IEEE") for more than fifteen years. From March 1991 to October 1994, I served as an Associate Editor for the IEEE publication called "IEEE Transactions on Education." I also served as a member of the Editorial Board on the IEEE Transactions on Microwave Theory and Techniques in the 1990-2000 timeframe.

E. Patents

14. My research and development work at the University of Texas has led to several innovative technologies. Based on my work, and that of others, I am a named inventor on at least 15 United States patents. These patents relate to a variety of technologies, including semiconductor devices with multiple current-voltage curves and zero-bias memory, semiconductor growth systems, sensor arrays, and bioelectronics, among others.

F. Qualifications

15. Based on my technical experience in the field of electrical engineering, including that summarized above and described in greater detail in my curriculum vitae, I consider myself to be an expert in the field of electronic communication systems and equipment.

16. I believe that I am qualified to provide an opinion as to what a person having ordinary skill in the art would have understood, known, or concluded during the timeframe of 1998-2000 (hereinafter, a "POSITA"). Such a person would have had (i) a Bachelor's degree in electrical or electronics engineering, or a similar scientific or technical degree including studies related to electronics and communications, or (ii) 3-5 years of comparable industry or academic experience.

II. MATERIALS CONSIDERED

17. I considered a number of materials in preparing this declaration. These materials are listed below:

- U.S. Patent No. 6,218,930 (the "'930 patent");
- File history for the '930 patent;
- File history for *inter partes* review of the '930 patent, Case No. IPR2013-00071;
- File history for *inter partes* review of the '930 patent, Case No. IPR2013-00092;
- File history for *inter partes* review of the '930 patent, Case No. IPR2013-00386;

- File history for *ex parte* reexamination of the ’930 patent, Control No. 90/012,401 (the “’401 reexamination”);
- File history for *ex parte* reexamination of the ’930 patent, Control No. 90/013,444 (the “’444 reexamination”);
- Network-1’s P.R. 4-1 disclosures in the present litigation, dated March 12, 2015;
- Defendants’ P.R. 4-1 disclosures in the present litigation, dated March 12, 2015;
- Network-1’s P.R. 4-2 disclosures in the present litigation, dated April 9, 2015;
- Defendants’ P.R. 4-2 disclosures in the present litigation, dated April 9, 2015;
- The parties’ joint P.R. 4-3 disclosures in the present litigation dated May 15, 2015, and amended P.R. 4-3 disclosures dated May 3, 2016, including the intrinsic and extrinsic evidence cited by the parties for the claim terms “data node”; “main power source”; “secondary power source”; “low level current”; “preselected condition”; “providing”; “can be sensed”; and “current”;
- Memorandum Opinion and Order construing claim terms of the ’930 patent in *Network-1 Security Solutions, Inc. v. Cisco Systems, Inc.*, No. 6:08-cv-30, dated February 16, 2010 (the “*Cisco* Markman Order”);
- Memorandum Opinion and Order construing claim terms of the ’930 patent in *Network-1 Security Solutions, Inc. v. D-Link Corp.*, No. 6:05-cv-291 dated November 20, 2006 (the “*D-Link* Markman Order”);
- Memorandum Opinion and Order denying Network-1’s motion for reconsideration regarding claim construction in *Network-1 Security Solutions, Inc. v. Cisco Systems, Inc.*, No. 6:08-cv-30, dated May 18, 2010;

- Memorandum Opinion and Order regarding Network-1's motion to exclude expert testimony in *Network-1 Security Solutions, Inc. v. Cisco Systems, Inc.*, No. 6:08-cv-30, dated June 30, 2010;
- Network-1's Opening Claim Construction Brief, dated May 3, 2016; and
- The declaration from Dr. James Knox submitted with Network-1's Opening Claim Construction Brief, dated May 3, 2016.

III. OVERVIEW OF THE '930 PATENT

18. The '930 patent states that its filing date is March 7, 2000, and claims priority to U.S. Provisional Application No. 60/123,688, filed on March 10, 1999. For purposes of this declaration, I have not assessed whether the '930 patent is in fact entitled to such a priority date.

19. The '930 patent generally relates to "apparatus and methods for automatically determining if remote equipment is capable of remote power feed and if it is determined that the remote equipment is able to accept power remotely then to provide power in a reliable non-intrusive way." '930 patent, col. 1, ll. 14-19.

20. As the '930 patent acknowledges, a variety of remote powering techniques were already known in the field before the filing date of the patent. For example, the patent notes that "[a] variety of telecommunications equipment is remotely powered today," i.e., before the '930 patent. *Id.* at col. 1, ll. 22-23. Examples included "Telephones and Network Repeater devices." *Id.* at col. 1, ll. 23-24. Other prior technologies specifically involved providing power over Ethernet data communications cabling. *See, e.g.,* Ex. 34 to Dkt. 596, U.S. Patent No. 5,994,998 to Fisher et al., at Abstract ("Electrical supply current, sufficient to power a wireless access point, is transmitted concurrently with a network data signal across a transmission line"); *id.* at col. 3, ll. 51-54 (discussing application in "ethernet" networks); *see also* Ex. 37 to Dkt. 596, U.S. Patent

No. 6,5535,983 to McCormack et al., at Abstract ("The system powered devices have circuitry for indicating the system power need to the hub, which has a power source for selectively supplying system power over the Ethernet.").

21. According to the "Background of the Invention" section of the patent, a stated objective is "to add remotely powered devices to a data network." *Id.* at col. 1, ll. 33-35. Another identified objective is "to provide methods and apparatus for reliably determining if a remote piece of equipment is capable of accepting remote power." *Id.* at col. 1, ll. 41-43.

22. In view of these objectives and the field of art, the '930 patent describes a specific approach for determining if a remote device is a capable of receiving power over a data signaling pair. According to the specification of the patent, a remote access device 10 is provided, which "requires power to carry out its operation and includes an internal dc-dc switching supply." *Id.* at col. 2, ll. 36-44. The remote access device may be a telephone 62, as shown in Figure 1. *Id.* at col. 3, ll. 60-66. A data signaling pair in the form of cable 12 connects the remote access device 10 to a network data node 14. *Id.* at col. 2, ll. 44-51. A main power source in the form of power source 16 is connected to cable 12 to supply a "power level sensing potential to the remote access equipment 10 over one of the cable conductors." *Id.* at col. 2, ll. 52-57. A remote power detector 22 operates a detection circuit consisting of a resistor 26 with shunting switch 28 connected in parallel to a resistor 30, which provides a path to ground. *Id.* at col. 2, ll. 59-65.

23. Detection of remote equipment is performed by delivering a "low level current (approx. 20 ma) to the network interface and measuring a voltage drop in the return path." *Id.* at col. 2, l. 66 – col. 3, l. 2. According to the '930 patent, "[t]here are three states which can be determined: no voltage drop, a fixed level voltage drop or a varying level voltage drop." *Id.* at col. 3, ll. 2-4. The first two states indicate that the access device is unable to accept remote

power. *Id*. at col. 3, ll. 4-11. The third state, a varying voltage level, indicates that the access equipment is capable of accepting remote power. *Id*. at col. 3, ll. 12-27. "The varying voltage is created by the remote power supply beginning to start up but the low current level is unable to sustain the start up." *Id.* at col. 3, ll. 14-16. If a varying voltage is detected, then power is provided to the access device from a secondary power source in the form of power supply 34, as shown in Figure 2. *Id*. at col. 3, ll. 28-31; col. 3, ll. 1-5. The above three states are the only voltage conditions contemplated by the '930 patent for purposes of determining whether the access device is capable of receiving power over the data signaling pair.

IV. CLAIM CONSTRUCTION ISSUES

24. I understand that, in the present litigation, Network-1 asserts claims 6, 11, 13, 17, 20, 21, 22, and 23 of the '930 patent. I also understand that Network-1 has recently disclaimed dependent claims 15 and 16 of the '930 patent, although the addition of these claims during reexamination remains a matter of public record and constitutes intrinsic evidence.

25. I also understand that Network-1 and the Defendants have agreed on the meaning of certain claim terms in the '930 patent and dispute the meaning of other claim terms. In this declaration, I express no opinion as to the correctness of the agreed constructions. Below, I address certain disputed claim terms.

26. I understand that words of a claim are generally given their ordinary and customary meaning, which is the meaning that the terms would have had to a POSITA as of the effective filing date of the patent application. I further understand that in determining the ordinary and customary meaning of a claim term, one should consider intrinsic evidence related to the patent, including the words of the claims themselves, the patent specification, and the prosecution history. In addition, certain extrinsic evidence, such as dictionary definitions, may

be considered in determining the meaning of claim terms, but are generally given less weight in comparison to the intrinsic evidence related to the patent.

27. I understand that while the specification is generally viewed as the single best guide for construing claim terms after the language of the claims, the specification cannot be used to narrow a claim term to deviate from the term's plain and ordinary meaning, unless the inventor acted as his own lexicographer or clearly disclaimed or disavowed claim scope. For terms that lack an ordinary and customary meaning in the relevant art, however, the specification may indicate the best context for deciphering the meaning of such terms. This analysis aligns with how a POSITA would attempt to understand the meaning of a claim term lacking an ordinary and customary meaning in the art.

A. "Data Node"

28. The term "data node" is recited in independent claims 6 and 20-23 of the '930 patent. Network-1 and the Defendants generally agree that the term "data node" refers to a "data switch or hub." The primary disagreement between Network-1 and the Defendants is whether the language "such as an Ethernet switch" should be added to the construction. In my opinion, the term "data node," as recited in the claims of the '930 patent would not be understood as limited to an "Ethernet switch." I express no opinion on whether it is proper to include an example like this (i.e., "such as . . .") in a claim construction.

29. Original claim 6 recites a "data node adapted for data switching" and, as further addressed below, does not further qualify or limit that term to a specific data protocol or addressing scheme. The term "data node adapted for data switching" is also recited in new claims 20-23, but claim 20 additionally recites an "Ethernet" data node adapted for data switching (identifying a specific type of data node) and claims 20, 21, and 23 recite in their preamble "an Ethernet data network" (suggesting a field of use). Because the parties have not

proposed separate claim constructions for the additional language in claims 20-23, I do not opine on those claim terms. Instead, I focus on the meaning of "data node" in independent claim 6 and how that term would be construed consistently across all claims, as I understand is generally required for purposes of claim construction. As part of my analysis, I considered the term as it appears in the claims, as well as other intrinsic evidence such as the specification of the '930 patent. Also, I reviewed other terms common to claim 6 and related to the meaning of the term "data node."

30. As a POSITA would readily perceive, claim 6 does not require that either the "data node" or the "access device"—or any other component—adhere to a particular data protocol or network topology. No such limitation is recited, expressly or inherently, in claim 6. Moreover, the parties' agreed constructions for the terms "access device" and "data signaling pair," which are common to and recited in independent claims 6 and 20-23, do not require any particular protocol or topology. According to these constructions, an "access device" is "a device that can receive and transmit data over a network." No specific technique is implicated in this agreed construction. Similarly, a "data signaling pair" is construed as "a pair of wires used to transmit data between the data node and the access device." According to this agreed construction, the data signaling pair is not uniquely associated with any network protocol or addressing scheme.

31. In addition, a POSITA would observe that the specification of the '930 patent similarly fails to impose a requirement of "Ethernet" communications. For example, in describing equipment that may receive remote power, the specification generally refers to "remote equipment" and "remotely powered devices." '930 patent, col. 1, ll. 14-19, ll. 33-35, 53-54; col. 2, l. 66 – col. 3, l. 27; col. 3, ll. 44-55. While a POSITA would also note that the '930

patent makes reference to Ethernet-based communications (*see id*. at col. 1, ll. 13-14, 45-48, 51-54; col. 2, ll. 36-39, 44-51; col. 3, l. 60 – col. 4, l. 5), none of these portions of the specification teach that such features are required for a "data node adapted for data switching." To the contrary, the specification also refers to types of data communications beyond Ethernet-based communications, such as telephony-based technologies. *Id*. at col. 1, ll. 33-40. The specification also broadly describes one goal of the invention as being "to provide methods and apparatus for reliably determining if a remote piece of equipment is capable of accepting remote power." *Id*. at col. 1, ll. 41-43. This is also consistent with the Examiner's citation of non-Ethernet prior art during original prosecution of the '930 patent, including telephone technologies using "[a] central office switch" for data switching (*see* U.S. Patent No. 5,289,359 to Ziermann at col. 2, ll. 60-61; Abstract) and a "switching system" for routing communications with telephones (*see* U.S. Patent No. 5,483,574 to Yuyama at col. 4, ll. 5-12).

32. Accordingly, in my opinion a POSITA would conclude that the term "data node" recited in the claims of the '930 patent is not limited to "an Ethernet switch."

B. "Main Power Source"

33. The term "main power source" is recited in independent claims 6 and 20-23, and dependent claims 15-17, of the '930 patent. As explained below, a POSITA would have concluded that the recited "main power source" was necessarily a DC power source, in view of the claim language, the disclosure of the '930 patent, and common knowledge possessed by a POSITA.

34. As recited in independent claims 6 and 20-23, the "main power source" has two functions. First, it is "connected to supply power to the data node." Second, a "low level current" (claims 6, 20, 22 and 23) or "current" (claim 21) is delivered "from said main power

source to the access device over said data signaling pair." As a POSITA would understand, this claim language indicates that the "main power source" is a DC power source.

35. In particular, in order for the "main power source" to provide operational power to the data node, a POSITA would understand that the power must be DC, rather than AC. Indeed, a POSITA would understand that virtually all devices that transmit data over a network are designed to operate at a specified DC voltage level, such as 5V, 12V, 48V, etc. This is consistent with the '930 patent's disclosure of "power source 16" as a "conventional main power supply used to power the node 14." A POSITA would understand this "conventional" power supply to be a "brick," i.e., a device that converts AC power (e.g., from a wall outlet) into DC power needed to operate the data node. Indeed, this is what is illustrated in Figure 3 of the '930 patent, where the "main power supply 70" receives its power from a typical AC wall socket, and in turn supplies operational power via the "Main Power Distribution Bus" to the data switches.

36. It would be very unusual—and certainly not contemplated by any disclosure in the '930 patent—for a network device to operate using AC power directly from, e.g., an AC wall socket. In my opinion, if a network device was to receive AC power, the device would likely either fail to function (i.e., because its requisite DC voltage was absent) or would be damaged because its circuitry was not designed to handle AC power. These basic DC power requirements of equipment that transmits data over a network would have been part of the common and routine knowledge possessed by a POSITA.

37. Further, in order for the "main power source" to provide the recited "low level current" to the access device, such that a "preselected condition" of a sensed voltage level can be used for "controlling power," the '930 patent teaches that the "main power source" must provide a DC current to the access device. As the patent explains, "[t]here are three states which can be

determined: no voltage drop, a fixed level voltage drop or a varying level voltage drop." '930 patent, col. 3, ll. 2-4. A POSITA would recognize that, if the "main power source" was providing an *AC current* (i.e., alternating current), it would not be able to detect the second described state—a fixed voltage drop—because the voltage drop would also be varying (alternating) in nature. The '930 patent further teaches that only the detection of the third state, a "varying voltage level," indicates "the presence of a dc-dc switching supply in the remote equipment," which is caused by "the remote power supply beginning to start up but the low level current is unable to sustain the start up." *Id*. at col. 3, ll. 12-16. As a POSITA would recognize, if the "main power source" was providing an *AC current* to the access device—rather than a DC current—the described system would falsely identify access devices because it would sense a *varying* (i.e., AC) voltage level in response to that AC current. Accordingly, if the "main power source" was providing AC current, the system would be inconsistent with the teachings of the specification. In my opinion, a POSITA would disagree with an interpretation of "main power source" that is inconsistent with these teachings of the '930 patent. By contrast, a "main power source" providing DC current would be in harmony with the teachings of the specification regarding the delivery of a "low level current" and sensing of a "preselected condition" of a voltage level.

38. In addition, if the "main power source" provided AC current as the "low level current" recited in claim 6, the system may suffer from significant signal distortion. Because AC current is a varying in nature, if it was imposed on the same wires (e.g., wires 6, 3, 2, and 1, from Figure 2 of the '930 patent) that carry data signals, the AC current may interfere with the data signals. This may render the data signals received at the access device unreadable. In this regard, a POSITA would know that AC current is not perfectly sinusoidal, but rather includes

noise and other distortion that renders it an imperfect approximation of a sine wave. While a perfect sine wave could be separated from the data signal on the wires at the access device without great difficulty, a noisy or distorted sine wave would be difficult to separate. By contrast, if the "main power source" was a DC power source, and provided a DC "low level current" to the access device, problems associated with signal distortion would be minimized.

39. I have also reviewed Dr. Knox's opinions on the meaning of the claim term "main power source." For several reasons, I disagree with Dr. Knox's analysis and ultimate conclusion.

40. Dr. Knox begins his analysis by focusing on the meaning of the term "power source," outside the context of the claims and specification of the '930 patent. Dkt. 596-51 at 16. Relying on an extrinsic prior art patent, U.S. Patent No. 5,994,998 to Fisher, Dr. Knox asserts that a "power source" would be a "source of power." *Id.* at 16-17. In my opinion, this is not how a POSITA would approach the task of understanding the term "main power source." To the contrary, a POSITA would begin with the meaning of "main power source" as it is used in the claims and as described in the specification, as I discussed above. A POSITA would also understand that construing "power source" to mean "source of power" would be a meaningless exercise, since the latter just rewords without explaining the former.

41. With regard to the DC nature of the "main power source," Dr. Knox once again begins his analysis by focusing on certain extrinsic prior art materials, rather than the claim language and specification of the '930 patent. Dkt. 596-51 at 19. According to Dr. Knox, certain prior art references indicate that a "power source" may be either an AC power source or DC power source" *Id.* at 19-22. Further, some prior art references refer specifically to a DC power source, while others refer specifically to an AC power source. *Id.* In my opinion, a POSITA would not try to understand the meaning of "main power source," as used in the claims of the

’930 patent, by reviewing how other patents use the different term “power source” in different applications. A POSITA would also recognize that, whether certain prior art references use the term DC power source, and others use the term AC power source, that is not indicative of the meaning of the “main power source” as recited in the claims of the ’930 patent. Indeed, Dr. Knox does not analyze the specific applications at issue in the prior art references he cites. Instead, he only refers to instances where the term “power source” is used. Contrary to the analysis of Dr. Knox, a POSITA would approach the task as I have outlined above, beginning with the claim language and specification of the ’930 patent.

42. Dr. Knox further refers to certain “documentation” from the Defendants in this litigation as evidence that supports his construction of “main power source.” *Id*. at 22-24. In particular, Dr. Knox highlights references to an “AC power source” in certain installation guides. *Id*. In addition to the fact that these installation guides are extrinsic materials with no particular connection to the ’930 patent, Dr. Knox’s reliance on them is illogical. Dr. Knox must first be assuming that these installation guides are referring to a “main power source” of the type recited in the claims of the ’930 patent. Yet Dr. Knox does not acknowledge making this assumption, much less support it. Nowhere, for example, does Dr. Knox explain how the “AC power source” referred to in these materials relates to the functions of being “connected to supply power to the data node” and “delivering a low level current,” as recited in claim 6 of the ’930 patent. Dr. Knox just highlights the word “AC power source” without considering how it functions in the context of the identified products. Nor does he compare such functionality to the ’930 patent. Accordingly, in my opinion Dr. Knox’s reliance on these materials is unsound.

43. Dr. Knox further asserts that the Defendants’ proposed construction of “main power source” means that the term “main” is being construed to mean “DC.” In my opinion, this

is a flawed analysis, which is disconnected from the claim language and specification of the ’930 patent. As discussed above, the claim language and specification compel the conclusion that the “main power source” is “a DC power source.” Because Dr. Knox does not consider these issues, but attempts to isolate the word “main” from “power source,” and assign meaning to “main” only after he has construed “power source,” Dr. Knox ends up with the illogical conclusion that the Defendants’ construction equates “main” with “DC.” Under a proper analysis, the term “main power source” should be construed in its entirety in the context of the claims and specification of the ’930 patent, as I have done above.

44. Dr. Knox presents “three power configurations” that he believes could serve as the “main power supply 70 of Figure 3” of the ’930 patent. *Id*. at 26-27. Nevertheless, Dr. Knox does not identify any support in the claim language or specification of the ’930 patent to support these “power configurations.” Each is presented as a mere conclusory statement, and fails to take into account the reasons outlined above that demonstrate that the “main power source” must be a DC power source. Regarding example 1, while Dr. Knox asserts that “main power supply 70” may provide “DC power to the access device 64,” no disclosure in the ’930 patent supports that hypothetical (and none is identified). *Id*. at 27. Instead, the ’930 patent makes clear that “main power supply 70” provides power to “8 port Ethernet switch 68.” ’930 patent, col. 3, l. 66 - col. 4, l. 1; Fig. 3. And regarding example 2, Dr. Knox proposes that “main power source 70” could be an “AC/AC isolation and/or voltage power supply.” Dkt. 596-51 at 27. Again, no support in the ’930 patent is cited and none supports this hypothetical. Moreover, if the “main power source” was an AC/AC power supply, the problems arising from the “low level current” being AC in nature, which I discussed above, would arise. In short, Dr. Knox has provided no reason why a POSITA would agree with his potential power configurations.

45. Lastly, I note that under both (1) Dr. Knox's construction of "main power source," which encompasses *AC* power sources (*id*. at 19), and (2) Dr. Knox's construction of "secondary power source," which allows the "main" and "secondary" power sources to be a *single* source of power (*id*. at 29), several significant problems would arise in the system described in the '930 patent.

46. These problems are illustrated by Figure 2 of the '930 patent, which describes "a power feed configuration for supplying power to the remote access equipment on the local area network." *Id*. at col. 2, ll. 26-28. The power supply 34 includes a "first center tap data transformer 36" and a "second center tap transformer 44." *Id*. at col. 3, ll. 31-37. The "[p]ower feed is through a center tap lead 39 and power return is through a center tap lead 45." *Id*. at col. 3, ll. 37-38. Figure 2 is reproduced below, with transformers 36 and 44 highlighted.

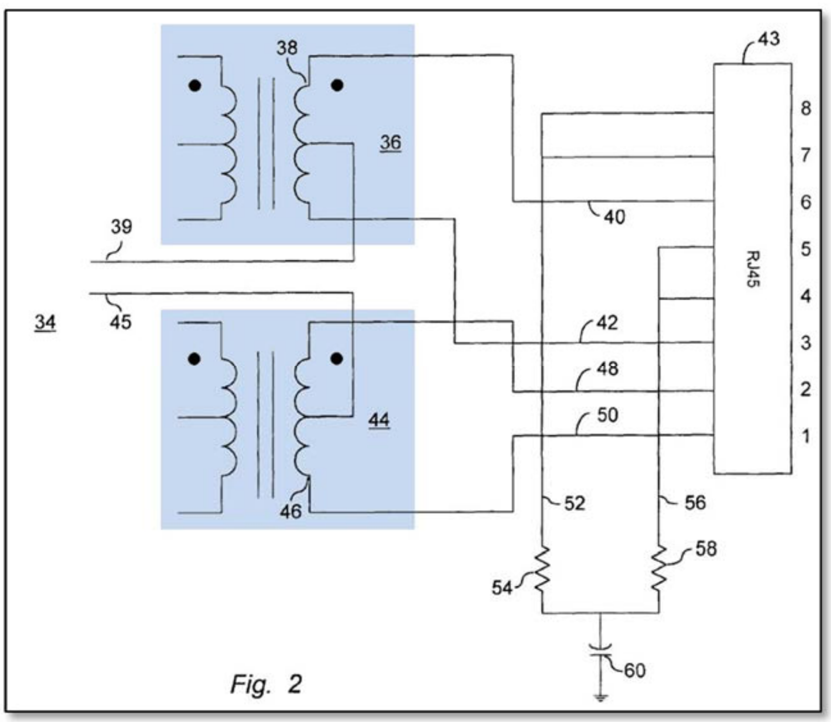


Fig. 2

47. Because transformers transfer electrical signals based on varying magnetic flux, they allow AC currents to pass through via mutual induction (because the two sides of a

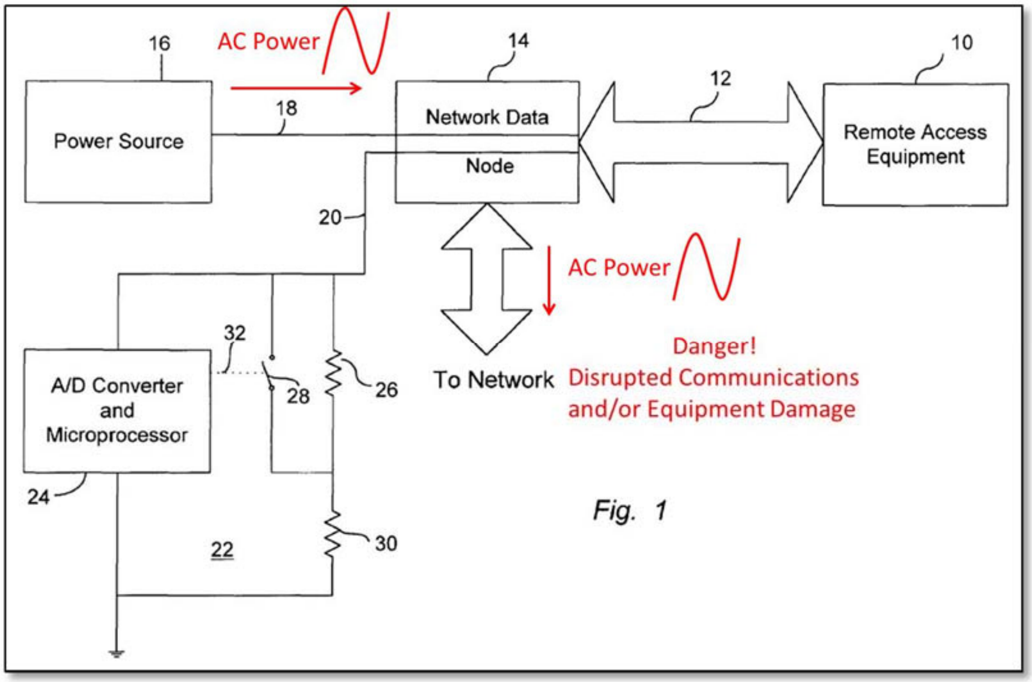
transformer share such varying flux) but block DC currents (because there is no DC connection between the two sides of a transformer). The only way to transfer DC current to one side of a transformer is via a direct connection, such as center tap leads 39 and 45. Such center tap leads allow the direct passage of DC current via leads 40, 42 and 48, 50.

48. Under Dr. Knox's argument, where a single power source (power source 16, from Figure 1) can be an *AC* power source that functions as both the "*main*" and "*secondary*" power sources, Dr. Knox asserts that power from that single power source enters the circuit of Figure 2 via center tap lead 39. *Id*. at 38. Contrary to this interpretation, a POSITA would recognize that, if the center tap lead 39 was carrying AC current, several significant problems in the circuit of Figure 2 would occur.

49. First, such AC current would interfere with the data being transmitted through the transformers to the connector 43 for transmission to the access device. Because AC current and data signals are both time-varying signals, the AC current would create interference in the data being transmitted. In addition, further interference could be caused by inductance between the AC current on the center tap leads 39 and 45, and their respective data wires 6, 3, 2, and 1. Signal interference of these types could lead to errors, if not an entire disruption, in the data communication between the data node and the access device.

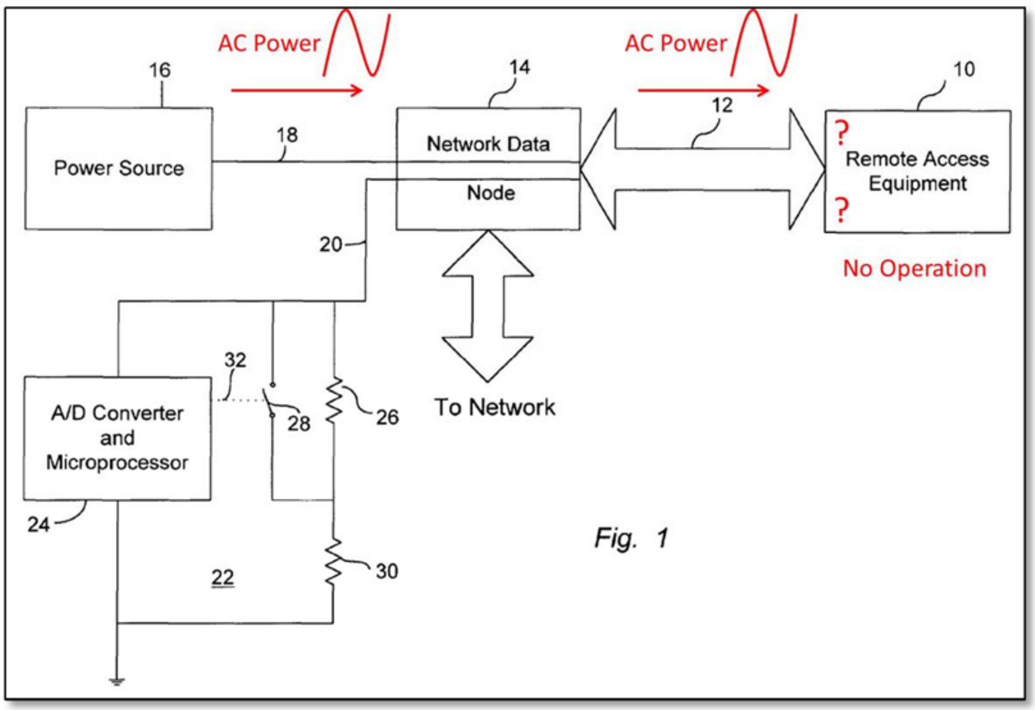
50. Second, such AC current would be free to flow back through transformers 36 and 44 into portions of the data network (e.g., into the data switch and components upstream of the data switch) that are not designed to handle such signals. That is, the transformers 36 and 44 cannot isolate the network from AC power; they only provide isolation from DC power. By introducing unwanted AC power into the data node via transformers 36 and 44, data

communications could be disrupted and network equipment could be damaged. These issues are illustrated in Figure 1 of the ’930 patent, as annotated below.



51. Third, if leads 39 and 45 were carrying AC power, such AC power would be delivered via lines 40, 42, 48, and 50 to pins 6, 3, 2, and 1 of the connector 43, and then to the access device. *See id*. at col. 2, ll. 26-28 (Figure 2 illustrates “a power feed configuration for supplying power to the remote access equipment on the local area network.”); *see also id*. at col. 3, ll. 28-31 (describing the “suitable remote power supply” in Figure 2). This would also cause the described system to become inoperable, because the remote equipment is described as having a “dc-dc switching supply” to receive operating power. *See id*. at col. 3, ll. 12-22. As a POSITA would understand, network devices such as an access device are designed to receive, and operate based on, DC power. The ’930 patent makes this point clear in its description of the access device: the “[r]emote access device 10 requires power to carry out its operation and includes an internal dc-dc switching supply which, in the absence of the present invention would be supplied

by an ac transformer adapter plugged in to the local 110 volt supply." *Id*. at col. 2, ll. 40-44. Because the access device requires DC power in order to function—whether from the data node or from a traditional AC adapter—if the access device was provided with AC power, it would not be able to start-up or function properly. This problem is illustrated in Figure 1 of the '930 patent, as annotated below.



52. For all of these reasons, a POSITA would understand that a combination of Dr. Knox's construction of "main power source" (to encompass *AC* current) and "secondary power source" (being the *same* as the "main power source") would be untenable in light of the disclosure of the '930 patent.

C. "Secondary Power Source"

53. The term "secondary power source" is recited in independent claims 6 and 20-23, and dependent claims 14-16, of the '930 patent. A POSITA would understand that the "secondary power source" is "a source of power connected to provide power between the data

node and the access device using the data signaling pair" and that "the secondary power source is physically separate from the main power source." I understand that the parties dispute whether the "secondary power source" is indeed "physically separate from the main power source." Below, I explain why the two claimed power sources must be physically separate based on the teachings of the '930 patent.

54. First, a POSITA would appreciate that the "main power source" and "secondary power source" drive separate *loads* with power. In particular, the language of claim 6 requires that "main power source" provides power to the "data node," and the "secondary power source" provides power to the "access device." In other words, a POSITA would understand that the "main" and "secondary" power sources are separate power driving points. During normal operation of a system corresponding to claim 6, the "main power source" would be driving, and operating, the data node, while the "secondary power source" simultaneously drives, and operates, the access device. This is consistent with the *Cisco* Markman Order, which explained that "physically separate" power sources are "physically separate 'driving points' because each power source 'drives' a separate load." *Cisco* Markman Order at 11-12.

55. With respect to the issue of physical separateness of the two power sources, in independent claims 6 and 20-23 the "main power source" supplies the power "*to the data node*." The "secondary power source," on the other hand, supplies power "*from the data node*." This claimed division between supplying power "to" and "from" the "data node" aligns with the natural meaning that a POSITA would ascribe to the terms "main" and "secondary" in view of the claim language. In other words, a "main" power source would be one upstream of a "secondary" power source.

56. This physical separateness is also confirmed by the different functions that the "main" and "secondary" power sources have in the claims. For example, according to claim 6, the "main" and "secondary" power sources are each separately referenced in the "providing" step. There must be provided "a main power source connected to supply power to the data node." There must also be provided "a secondary power source arranged to supply power from the data node via the data signaling pair to the access device." Further, the "main power source" must be configured to "deliver[] a low level current" while the "secondary power source" must be the subject of the "controlling power" requirement whereby power "supplied by said secondary power source to said access device" is controlled.

57. Further, as a POSITA would recognize, the fact that the claims specify distinct connectivity requirements for the two power sources also demonstrates the physical separateness of the power sources. For example, claim 6 uses the language "connected to . . ." and "arranged to . . . via the data signaling pair to the access device" to differentiate the "main" and "secondary" power sources, which also indicates the physical separateness of the two power sources. As a POSITA would perceive, these distinct connectivity requirements in claim 6 indicate physically separate power sources.

58. A POSITA would also recognize that the language of the claims, including "main power source" and "secondary power source," reflects a unique choice of words. That is, the claims do not recite "power sources" in an abstract or generic sense. For example, the claims do not recite merely "a power source," "a plurality of power sources," or "first and second power sources." Instead, as a POSITA would recognize, the inventors' use of the more particularized words "main" and "secondary" carries a more specific meaning that pertains to the arrangement and functionality of the power sources. This unique choice of words would be seen by a

POSITA as denoting physically separate power sources, not merely any power sourcing arrangement.

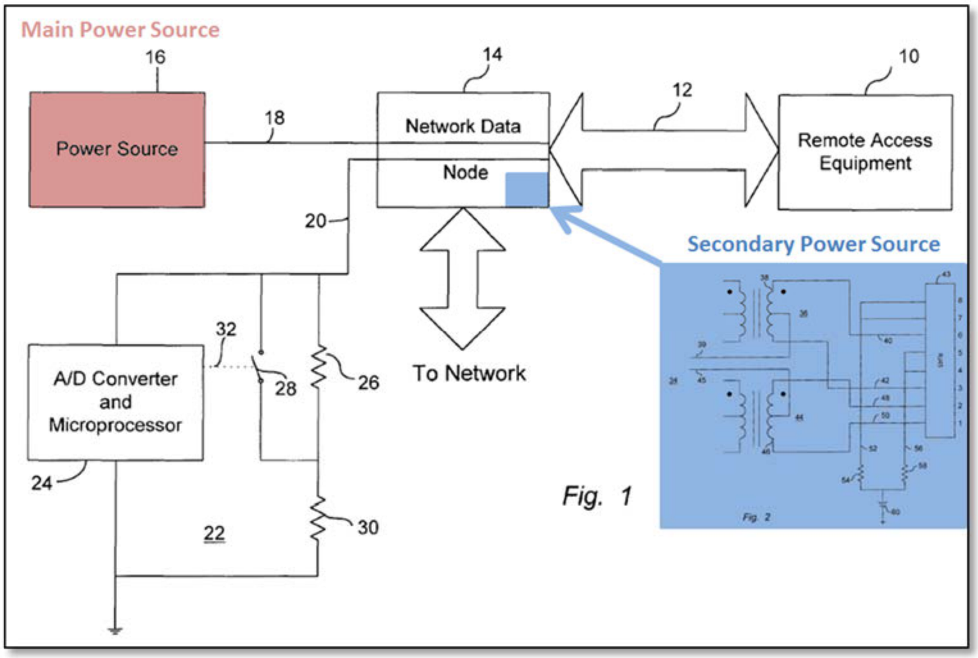
59. As a POSITA would understand, all of the above distinctions in the claim language between the "main" and "secondary" power source would be unnecessary, if not nonsensical, if "the secondary power source can be the same source of power as the main power source," as Network-1 asserts. For example, it is unclear why, if the two power sources were "the same source of power," the claims would differentiate between the functions of the two power sources. Similarly, it is unclear why the claims would specify different powering functions "to" and "from" the "data node adapted for data switching." A POSITA would readily understand that the structure of claim 6 is not so abstract and malleable.

60. Further, a POSITA would appreciate that, in all other instances in the original claims of the '930 patent where the terms "main power source" and "secondary power source" appear, the same physical separateness is repeated. In particular, several claims further address the requirement in claim 6 of "controlling power supplied by said secondary power source to said access device." These include, for example, claim 2, which recites "supply[ing] phantom power from the secondary power source to the access device," claim 3, which recites "increas[ing] the power supply from the secondary power source to the access device," and claim 9, which recites "decreas[ing] power from the secondary power source if voltage level drops on the data signaling pair, indicating removal of the access device." None of original claims 1-9 mixes and matches between the different arrangement and functionality assigned to the "main" and "secondary" power sources. To the contrary, as a POSITA would recognize, these claims consistently reinforce the separate arrangement and functionality of those two power sources.

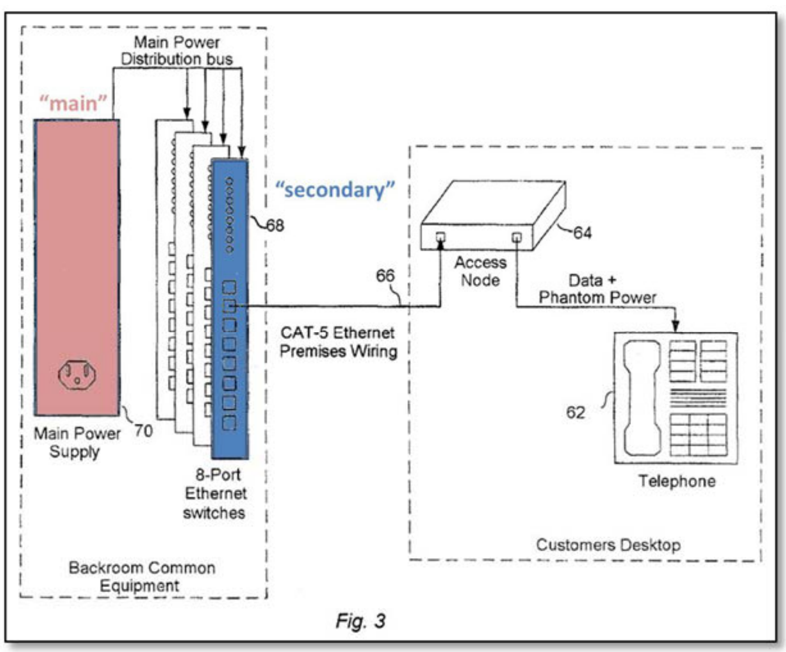
61. The specification of the ’930 patent also teaches that the “main” and “secondary” power sources are physically separate. In particular, as discussed below, each of Figures 1-3 illustrates the physical separateness of these two power sources.

62. Figure 1 illustrates a “remote power automatic detection system.” ’930 patent, col. 2, ll. 21-25. As depicted in the figure, “a power source 16, which may be the same as the conventional main power supply used to power the node 14, is connected to cable 12 via lines 18 to supply a power level sensing potential to the remote access equipment 10 over one of the cable conductors.” *Id*. at col. 2, ll. 52-57. That is consistent with the language of claim 6, which requires that the “main power source” provide power “to the data node” and a low level current to the “access device.” Further, claim 6 also claims a “secondary power source” that is “arranged to supply power from the data node . . . to the access device.” The ’930 patent separately describes power being supplied when “switch S1” (which is not indicated in any of the figures) is closed and, after “a second, software level confirmation,” the “remote equipment is identified as known access equipment capable of accepting remote power.” *Id*. at col. 3, ll. 24-27. The only switch shown in Figure 1, switch 28, is clearly physically separate from the power source 16.

63. Further confirming this physical separateness, the specification explains that Figure 3 “illustrates the physical layout of components corresponding to the schematic diagram of FIG. 1.” *Id*. at col. 3, ll. 59-60. The specification states that the “8 port Ethernet switch 68 [] is powered from a main power source 70.” *Id*. at col. 3, l. 66 – col. 4, l. 1. The other power source, the “remote power supply 34 discussed in FIG. 2,” is included in the “Ethernet switch card” itself. *Id*. at col. 4, ll. 1-4. This configuration is illustrated in the combination of Figures 1 and 2, as annotated below.



64. The specification also confirms these teachings in Figure 3. The annotated version of Figure 3, reproduced below, also plainly illustrates physically separate "main" and "secondary" power sources, where the secondary power source is included in the data node itself, as discussed above. *Id*. at col. 4, ll. 1-4.



65. Accordingly, in view of the claim language and the specification of the '930 patent, a POSITA would understand the "secondary power source" as being physically separate from the "main power source."

66. I have also reviewed the opinions from Dr. Knox regarding the meaning of the "secondary power source." In my opinion, Dr. Knox's conclusion that the "main" and "secondary" power sources need not be physically separate is unsound.

67. As with Dr. Knox's other opinions addressed above, his opinion on "secondary power source" begins not with the claim language or specification, but rather expert testimony from an *inter partes* review proceeding involving a different standard for claim construction. This is not how a POSITA would attempt to understand the meaning of the term "secondary power source." Further, I understand that a different, broader claim construction standard applies in *inter partes* review proceedings compared to the standard that applies in the present case. Accordingly, I do not understand the quoted statements to be directed to the proper claim construction in this case. In any event, in this declaration, I offer my independent opinions on the meaning of "secondary power source" under the applicable claim construction standard in this case. I do not address what the proper construction of that term would be in an *inter partes* review proceeding.

68. Dr. Knox continues his analysis by looking to an extrinsic dictionary definition of the term "secondary." Dkt. 596-51 at 30. Dr. Knox then considers this definition in the term "secondary power source" to arrive at a meaning divorced from the surrounding language in claim 6, which I addressed above. *Id*. In my opinion, this is a flawed analysis. By focusing on individual words in isolation, relying primarily on dictionary definitions, and disregarding the surrounding claim language, Dr. Knox fails to properly consider the context in which "secondary

power source" is used in claim 6. His analysis, which does not address the considerations grounded in the claim language that I discussed above, leads to an unreliable construction, which in my opinion is incorrect.

69. Dr. Knox then asserts that "independent claims of the '930 patent (claims 6, 20, 21, 22, and 23) do not include any language that restricts the configuration, placement, or construction of the 'secondary power source' that performs this secondary function and do not specify any relationship between the 'main power source' and the 'secondary power source.'" *Id*. at 30-31. Nevertheless, Dr. Knox does not explain or support these conclusory statements with any analysis. To the contrary, as I discussed above, the terminology and structure of the language in claim 6 confirms that the "main" and "secondary" power sources must be physically separate. Dr. Knox does not account for this analysis at all in making his statements about the claim language.

70. Dr. Knox next asserts that "power source 16," as shown in Figure 1 of the '930 patent, supports his position that the recited "main" and "secondary" power sources can be the same source of power. This is incorrect. As described in the specification, "power source 16 . . . may be the same as the conventional main power supply used to power the node 14, [and] is connected to cable 12 via lines 18 to supply a power level sensing potential to the remote access equipment 10 over one of the cable conductors." '930 patent, col. 2, ll. 52-57. This corresponds to the language in claim 6 of "a main power source connected to supply power to the data node" and "delivering a low level current from said main power source to the access device over said data signaling pair." Yet nothing in the specification indicates that "power source 16" also performs the recited functions of the "secondary power source." Indeed, Dr. Knox fails to explain where the specification describes such functionality. While Dr. Knox states that, "[w]hen

in the secondary state (switch 28 closed), the power provided by power source 16 increases to the operational level required to operate access device 10," he cites no disclosure of the '930 patent actually describing that functionality. *Id*. at 33. Instead, he appears to be guessing at potential circuit configurations not described in the '930 patent. In any event, Dr. Knox's assumption that "power source 16" can serve as both the "main" and "secondary" power source is not what is claimed in claim 6, since the language and structure of claim 6 directly conflict with such an interpretation.

71. To the contrary, the functionality of the "secondary power source" is described with reference to Figure 2. As the specification explains, "a suitable remote power supply is shown generally as 34, which may be conveniently incorporated into an Ethernet 8 port switch card." *Id*. at col. 3, ll. 28-31. "Remote power is delivered to the remote equipment over the existing data signaling pairs (phantom power feed)." *Id*. at col. 3, ll. 44-48. As shown in Figure 3, and as I discussed above, the power source in data switch 68 is physically separate from the power source in main power supply 70.

72. I also note that Dr. Knox makes the following statements: "When in the secondary state (switch 28 closed), the power provided by power source 16 increases to the operational level required to operate access device 10," and "[t]herefore, the power source 16 meets the requirements of the "secondary power source" when in this secondary state because it is a source of secondary power." Dkt. 596-51 at 33. Nevertheless, Dr. Knox fails to cite any evidence (the specification of the patent or otherwise) to support these statements. In my opinion, as discussed above, nothing in the '930 patent suggests that power source 16 performs the functions of both the "main" and "secondary" power sources. In this regard, I disagree that the sketch created by Dr. Knox, which he labels "Figure B," corresponds to any disclosure of the '930 patent. *Id*. at

35-36. This "Figure B" is unsupported by, and in fact entirely inconsistent with, the claims and specification of the '930 patent, for the reasons discussed above. For example, the switch shown in Dr. Knox's Figure B is a double throw switch configured in a completely different way from the single throw switch 28 shown in '930 patent, Figure 1. A POSITA would thus not deem this figure consistent with the disclosure of the '930 patent.

D. "Low Level Current"

73. The term "low level current" is recited in independent claims 6, 20, 22, and 23, and dependent claims 12-14 of the '930 patent. In my opinion, a POSITA would construe "low level current" to mean "a current sufficient to cause the access device to start up, but not sufficient to sustain the start up," as stated in the Defendants' proposed construction. By contrast, a POSITA would find that Network-1's proposed construction—"a current at a level that is sufficiently low that, by itself, it will not operate the access device; a data signal is not a low level current"—is overly broad, ambiguous, and at odds with the teachings of the '930 patent.

74. First, a POSITA would recognize that "low level current" has no ordinary or customary meaning in relation to electronic circuits, data networks, or any other relevant field. That is, while the term "current" has a known meaning, qualifying a current as being "low level" would be considered by a POSITA to be inherently ambiguous. A POSITA would understand that the same current level may be considered "low level" for certain applications (e.g., powering an electric motor) but "high level" for other applications (e.g., powering a microprocessor). Accordingly, a POSITA would turn to the specification of the '930 patent for further guidance on the proper interpretation of the recited "low level current" term.

75. With reference to the specification, a POSITA would find that the most relevant disclosure is found at column 2, line 66 through column 3, line 19. Here, the specification

explains that, after a "low level current (approx. 20 ma)" is applied "to the network interface," a "voltage drop" in the return path is measured. *Id.* at col. 2, l. 66 – col. 3, l. 2. As the specification explains, "[t]here are three states which can be determined: no voltage drop, a fixed level voltage drop or a varying level voltage drop." *Id.* at col. 3, ll. 2-4. No voltage drop indicates that the access device "does not contain a dc resistive termination" and is "unable to support remote power feed." *Id.* at col. 3, ll. 4-7. A fixed voltage drop indicates that the access device does have a "dc resistive termination" and that it is also "unable to support remote power feed." *Id.* at col. 3, ll. 7-11. The only disclosed state that can identify a device capable of accepting remote power is a "varying voltage level." As the patent explains, "[t]he varying voltage level is created by the remote power supply beginning to start up by the low level current is unable to sustain the start up." *Id.* at col. 3, ll. 14-16. In particular, the varying voltage level (e.g., a "sawtooth" voltage) results from the repeated start up and shut down of the power supply in the access device. *Id.* A POSITA would also observe that there are no other embodiments disclosed or envisioned in the specification, other than the one involving the three states identified above.

76. Based on this disclosure, a POSITA would understand that a "low level current," in the context of the '930 patent, is described in relation to what *effect* it causes on the access device, including a power supply thereof. In particular, the "low level current" must be sufficient to initiate a start up of the access device (e.g., a start up of the "dc-dc switching supply" or other power supply in the access device), but not so large as to sustain the start up of the access device. As a POSITA would understand, this would be a function of three variables: the voltage associated with the low level current, the current associated with the low level current, and the load characteristics of the access device. Thus, no current level, standing alone, would

necessarily be sufficient (or insufficient) to initiate the startup of the access device. Instead, a current level only has relevance in the context of its associated voltage and the load produced by the access device.

77. In my opinion, the Defendants' proposed construction accurately articulates this concept. In particular, the Defendants' proposed construction explains the meaning of a "low level current" in relation to the only reasonable guidepost provided by the specification of the '930 patent—the start up of the access device. The Defendants' construction is entirely consistent with, and supported by, the disclosure of the '930 patent discussed above. As a POSITA would determine, nothing in the '930 patent provides meaningful guidance for interpreting the "low level current" in any other manner.

78. By contrast, Network-1's proposed construction would be understood by a POSITA as being overly broad, ambiguous, and disconnected from the disclosure of the '930 patent. First, a POSITA would appreciate that ascribing "a level" to the low level current is not meaningful, unless either its corresponding voltage or the load characteristic of the access device is known, for the reasons given above. A current at a certain "level" means nothing, standing by itself, in the context of the '930 patent. Second, by encompassing any "current" that does not operate an access device, Network-1's construction attempts to cover subject matter nowhere disclosed or contemplated in the '930 patent. As a POSITA would recognize, some current levels may be above zero, but still so low that they will not begin the startup of a power supply in the access device. Nevertheless, as described in the '930 patent, that does not make such currents "low level currents."

79. To the contrary, the '930 patent specifically teaches that when "no voltage drop" or "a fixed level voltage drop" is detected, that indicates that the access device is "*unable* to

support remote power feed." *Id*. at col. 3, ll. 4-11 (emphasis added). Network-1's proposed construction directly conflicts with these teachings, because it embraces currents that produce "a fixed level voltage drop."

80. Under Network-1's construction of "low level current," combined with its broad construction of "preselected condition," a current may be applied that is too *low* to cause the access device to operate, yet is still above zero amperes. Even though the access device is not able to accept remote power, it could be incorrectly identified as being *able* to support remote power under Network-1's construction, because it does not cause the access device to operate. The non-operational current would produce a detectable "fixed voltage drop" (e.g., a voltage drop caused by the non-zero current flowing through resistors 26 and 30 in detector circuit 22). *See id*. at Figure 1. Under Network-1's construction, this would lead to supplying full power to the access device, even though it cannot accept remote power. Indeed, Network-1's construction would incorrectly embrace all currents that are insufficient to cause the access device to operate, despite the teachings in the '930 patent to the contrary. This could potentially be hazardous for both the access device and other network equipment. The Defendants' construction avoids these problems, because a current insufficient to cause the access device to start up would not qualify as a "low level current" under the Defendants' construction, and thus would not incorrectly identify such a device as being unable to support remote power.

81. Accordingly, given the teachings of the specification, a POSITA would conclude that the Defendants' construction accurately captures the meaning of a "low level current"—"a current sufficient to cause the access device to start up, but not sufficient to sustain the start up." Based on the same intrinsic teachings, a POSITA would conclude that Network-1's proposed construction is unjustifiably broad and contrary to the teachings of the '930 patent.

82. I have also reviewed Dr. Knox's opinions regarding the meaning of the term "low level current." I disagree with Dr. Knox's analysis and the ultimate conclusion he reaches.

83. First, Dr. Knox's analysis of the specification, with regard to the term "low level current," essentially ignores the most relevant disclosure: column 2, line 66 through column 3, line 19, where three specific voltage states are considered. Dr. Knox refers to broader notions of "the inventors' purpose," and quotes general language from the '930 patent. *Id*. at 42-43. Most conspicuously, Dr. Knox begins with the following quoted language from column 2, line 66 through column 3, line 1: "Automatic detection of remote equipment being connected to the network is accomplished by delivering a low level current." *Id*. at 42. Dr. Knox ends this quotation mid-sentence, however. The remainder of the sentence reads: ". . . (approx. 20 ma) to the network interface and measuring a voltage drop in the return path." '930 patent, col. 3, ll. 1-2. The next sentence refers to the "three states which can be determined: no voltage drop, a fixed level voltage drop or a varying level voltage drop." *Id*. at col. 3, ll. 2-4. Despite this being the most instructive disclosure in the '930 patent on the meaning of the term "low level current," Dr. Knox essentially ignores it. This, in my opinion, is a flawed analysis and is not how a POSITA would interpret the term "low level current."

84. Dr. Knox next asserts that the construction I set forth above is incorrect because it "is not based on the purpose of the invention." Dkt. 596-51 at 44. Dr. Knox supports this statement by asserting that, while the construction I identified is consistent with a "particular embodiment" of the '930 patent, it does not cover "all embodiments." *Id*. at 45. Nevertheless, Dr. Knox does not describe any other embodiments. Indeed, he offers no analysis on this point. In my opinion, no other embodiments are disclosed other than the embodiment involving three potential voltage states, as I described above. Dr. Knox also asserts that this construction

improperly assumes that a "dc-dc switching supply" in the access device is treated as a claim limitation. *Id*. Yet, immediately thereafter, Dr. Knox inconsistently contends that the construction is incorrect because it does not focus on the "dc-dc switching supply" in the access device. *Id*. at 45-46. Regardless of which critique Dr. Knox settles on, the construction I set forth above does not specifically limit the term "low level current" to a "dc-dc switching supply." Lastly, while Dr. Knox seeks to distinguish between the access device starting up, and "beginning" to start up, he offers no substantive difference between the two concepts. *Id*. at 46.

E. "Preselected Condition"

85. The term "preselected condition" is recited in independent claims 6 and 20-23 of the '930 patent. Based on the intrinsic and extrinsic evidence, a POSITA would understand the term to mean "a condition of the sensed voltage level that indicates whether a power supply of the access device begins to start up but is unable to sustain the start up," as set forth in the Defendants' proposed construction. A POSITA would also find Network-1's proposed constructions to be vague, unduly broad, and inconsistent with the teachings of the '930 patent.

86. First, as with the term "low level current," a POSITA would understand that the term "preselected condition" has no ordinary and customary meaning in the fields of electronic circuits, network devices, or any other relevant field. Indeed, upon seeing the term "preselected condition" in the claims of the '930 patent, a POSITA would look to the specification for guidance in interpreting the term before being able to assign any particular meaning to it.

87. Because the term "preselected condition" is not recited in the specification, a POSITA would first have to understand the context in which the term was used in the claim to identify the corresponding disclosure. Here, claim 6 is directed to remotely powering an access device, and the "preselected condition" must indicate when to control power to the access device. In searching for teachings relevant to a "preselected condition," a POSITA would therefore look

to the specification for a discussion of conditions under which a power supply will provide power to an access device.

88. As with the term "low level current," a POSITA would find that the most relevant disclosure in the '930 patent regarding the meaning of "preselected condition" is found at column 2, line 66 through column 3, line 19. As discussed above, this portion of the specification teaches that, after a "low level current (approx. 20 ma)" is applied "to the network interface," a "voltage drop" in the return path is measured (*id.* at col. 2, l. 66 – col. 3, l. 2) and that "[t]here are three states which can be determined: no voltage drop, a fixed level voltage drop or a varying level voltage drop" (*id.* at col. 3, ll. 2-4). These three disclosed states of the measured or sensed voltage are summarized in the table below.

Sensed Voltage Condition	**Power Can Be Supplied?**
No Voltage	No
Fixed Level Voltage	No
Varying Level Voltage	Yes

89. As seen in the chart above, the specification teaches a POSITA only one condition, or state, that provides an indication that the power supply of the access device is trying to start up—that of a varying voltage level. The specification describes how a "varying voltage level" may be detected based on a "dc-dc switching supply in the remote equipment" beginning to "start up" but being "unable to sustain the start up." *Id.* at col. 3, ll. 14-16. From the detected varying voltage level, an inference is made that an otherwise unknown access device is trying repeatedly to start up, and that it therefore is capable of being powered. In contrast, the other states of a fixed voltage drop or no voltage drop provide no such inference, but rather indicate

that nothing, or only a resistive termination, is present. The Defendants' construction thus captures the meaning of "preselected condition" by interpreting it to mean "a condition that indicates whether a power supply of the access device begins to start up but is unable to sustain the start up."

90. Once again, Network-1's proposed constructions depart from, and actually conflict with, the teachings of the '930 patent. Network-1's "Proposal 1," "Proposal 2," and "Proposal 3" share a common flaw. Each construction fails to describe what the "preselected condition" itself is, and instead offers no guidance at all (Proposal 1) or focuses only on a use of the "preselected condition" (Proposal 2 and Proposal 3). As a POSITA would recognize, these constructions, just like the term "preselected condition" itself, have no particular meaning apart from the teachings of the specification. That is, Network-1's constructions provide no guidance regarding *what makes* a "condition" or "parameter" indicate that an access device can accept remote power. A "condition" or "parameter" of a voltage level, considered in isolation, does not necessarily mean that the access device can accept (or not accept) remote power. As noted above, an inference must be drawn from the condition or parameter that a power supply of the access device begins to start up but is unable to sustain the start up. As a POSITA would understand, different conditions or parameters of a voltage level may indicate different things, depending on how a circuit designer chose to configure a system. Accordingly, a POSITA would conclude that Network-1's open-ended constructions that encompass "any condition" of the sensed voltage that can be used in a detection scheme add ambiguity to the claims rather than clarity.

91. A POSITA would also recognize other deficiencies with respect to Network-1's proposed constructions. For example, Proposal 1 and Proposal 2 begin with "any condition of

the sensed voltage level." The breadth of these proposed constructions, when considered together with the requirements of either "selected in advance of the sensing" or "indicating whether an access device is capable of accepting remote power," creates a significant problem with both proposals. In particular, it appears that Network-1 is attempting to expand the meaning of "preselected condition" to cover two specific conditions that are specifically disallowed in the specification of the '930 patent.

92. The specification makes clear, as discussed above, that the sensed conditions of "no voltage drop" and "a fixed level voltage drop" both indicate that an access device is "*unable* to support remote power feed." *Id*. at col. 3, ll. 4-11 (emphasis added). Despite this clear teaching in the specification, it appears that Network-1 is seeking to construe "preselected condition" so that both conditions can indicate that an access device is *able* to accept remote power. Because a POSITA would clearly understand that the specification teaches that "no voltage drop" and "a fixed level voltage drop" are conditions that indicate that an access device *cannot* accept remote power, a POSITA would find that the "preselected condition" recited in the claims could not cover either type of voltage condition. To the extent that Network-1's proposed constructions seek to cover such prohibited voltage conditions, a POSITA would find that Network-1's constructions are directly contrary to the teachings of the '930 patent. By contrast, a POSITA would find that the Defendants' construction avoids such inconsistencies, because the Defendants' construction requires a voltage condition indicating whether a power supply of the access device begins to start up but is unable to sustain the start up. Such a condition would not be "no voltage drop" and "a fixed level voltage drop," since neither is associated with a power supply starting up and being unable to sustain its start up.

93. Lastly, Network-1's Proposal 3 is unhelpful because it adds ambiguity to the claims. The language "that indicates whether an access device is able to accept remote power from the data node" highlights the underlying question of what qualities, of the "preselected condition," make it indicate whether an access device is able to accept remote power from the data node in the first place. A POSITA would thus have difficulty applying this construction without knowing what such qualities are. As described above, a POSITA would have no way of interpreting the language "preselected condition" other than referring to the guidance in the specification which, in the '930 patent, supports the construction I articulated above.

94. I have also reviewed Dr. Knox's opinions regarding the meaning of the term "preselected condition." In my opinion, Dr. Knox does not offer plausible support for any of his three constructions.

95. As with many of his other claim construction analyses, Dr. Knox begins his analysis of this term, not with the claim language or specification of the '930 patent, but instead with extrinsic dictionary definitions. Dkt. 596-51 at 50. Using these extrinsic definitions, Dr. Knox seeks to construe the word "preselected" in isolation, and then insert that definition into the claim language. *Id*. at 50-51. That is not how a POSITA would approach understanding the meaning of "preselected condition." Instead, a POSITA would consider the term "preselected condition" as it appears in claim 6 as a whole, and in light of the specification. As a POSITA would recognize, contrary to Dr. Knox's analysis, the term "preselected condition" has no known meaning in the art. For the reasons I discussed above, therefore, a POSITA would turn to the specification of the '930 patent for guidance, not to extrinsic dictionaries.

96. Dr. Knox also asserts that his Proposal 1 is correct, because "a valid preselected condition can be any condition that differentiates access devices that are capable of accepting

remote power from ones that are not." *Id*. at 52. This statement, however, disregards the actual teachings of the '930 patent. As discussed above, the '930 patent teaches that "[t]here are three states which can be determined: no voltage drop, a fixed level voltage drop or a varying level voltage drop" (*id*. at col. 3, ll. 2-4). As disclosed, only the varying level voltage drop indicates that an access device can handle remote power. Thus, to the extent that Dr. Knox intends to include a fixed level voltage drop, or no voltage drop, in his language "any condition," he would be directly contradicting the teachings of the '930 patent.

F. "From Said Main Power Source"

97. In my opinion, a POSITA would find that the language "from said main power source," as used in claim 6 of the '930 patent, would be understood to mean "supplied by a main power source."

98. In particular, claim 6 recites "delivering a low level current from said main power source to the access device over said data signaling pair." In terms of this claim language, a POSITA would recognize that the "low level current" is coming from a "power source," specifically the "main power source." A POSITA would further recognize that the basic function of a power source is to supply power. This is also described in the '930 patent, where the "power source 16" is used to "supply a power level sensing potential to the remote access equipment 10 over one of the cable conductors." '930 patent, col. 2, ll. 52-57. Thus, construing the term "from said main power source" as meaning "supplied by a main power source" would be the meaning a POSITA would assign to the term in light of the claim language and the specification.

99. I note that Dr. Knox also addresses the term "from said main power source," although his opinions are primarily legal arguments as opposed to technical opinions. For example, Dr. Knox expresses his view on the conduct of "10-plus years of litigation" where this term was not specifically construed, what "a jury can easily understand," how the construction

"could be inappropriately applied," and a claim construction decision from an unrelated case. Dkt. 596-51 at 55-57. I express no opinion on these legal arguments.

100. Lastly, I note that Dr. Knox tries to manufacture inconsistency with this construction, by replacing instances of the word "from" in the specification with the language "supplied by." *Id*. at 57-58. This is a flawed analysis, first and foremost, because it confuses claim language with description in the specification. Further, Dr. Knox focuses on portions of the specification unrelated to the language in claim 6 of "delivering a low level current from said main power source to the access device over said data signaling pair." *Id*. Conspicuously, he disregards the disclosure of the '930 patent, where the "power source 16" is used to "supply a power level sensing potential to the remote access equipment 10 over one of the cable conductors." '930 patent, col. 2, ll. 52-57. This disclosure, which does relate to the claim language at issue in claim 6, directly supports the construction I have set forth.

V. CONCLUSION

101. This declaration presents my opinions to date regarding the matters set forth above. I reserve the right to supplement my opinions if or when Network-1 or its representatives clarifies their positions, including, for example, their interpretation of the claims, or present new arguments in a reply or otherwise. Finally, I reserve the right to create demonstrative exhibits, summary charts, and the like that may be useful in presenting my opinions in further proceedings in this case.

102. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct, and that this declaration was executed this 20th day of May, 2016, in Austin, Texas.

Respectfully submitted,

Dean P. Neikirk, Ph.D

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Dean P. Neikirk

Professor, Cullen Trust for Higher Education Professorship in Engineering (No. 7)
Department of Electrical and Computer Engineering
Cockrell School of Engineering
The University of Texas at Austin

Citizenship: USA

Education:

Oklahoma State University (Physics and Mathematics; with Honors)	B.S.	1979
California Institute of Technology (Applied Physics)	M.S.	1981
California Institute of Technology (Applied Physics)	Ph.D.	1984

Professional Experience:

Assistant Professor, University of Texas at Austin, Jan. 1984 - Aug. 1988
Associate Professor, University of Texas at Austin, Sept. 1988- Aug. 1992
Full Professor, University of Texas at Austin, Sept. 1992-present
Associate Dean of Graduate Studies, August 2014 - present

Honors and Awards:

- 1984 Marconi International Fellowship Young Scientist Award "for contributions to the development of millimeter wave integrated circuits especially in the areas of detectors and imaging arrays."
- Listed in the Second Edition of Who's Who in Frontiers of Science and Technology, 5th Edition of Who's Who in Technology Today, 1994 American Men & Women of Science; 1985 Outstanding Young Man of America, 1989 Outstanding Young Man of America; 7th Edition of Who's Who in Technology.
- 1984-85 Engineering Foundation Faculty Award, University of Texas at Austin Engineering Foundation Advisory Council.
- 1985-90 General Motors Foundation Centennial Teaching Fellowship, University of Texas at Austin.
- 1985-86 IBM Corporation Faculty Development Award
- 1986 National Science Foundation Presidential Young Investigator.
- 1987 Award for Outstanding Engineering Teaching by an Assistant Professor, College of Engineering, University of Texas at Austin.

- 1990-1992 Temple Foundation Endowed Faculty Fellowship (No. 1), University of Texas at Austin.
- 1992-present Cullen Trust for Higher Education Professorship in Engineering (No. 7), University of Texas.
- 1997 College of Engineering Award for Outstanding Teaching in the Department of Electrical and Computer Engineering, University of Texas at Austin.
- 2003 Department of Electrical and Computer Engineering Gordon T. Lepley IV Endowed Memorial Teaching Award, University of Texas at Austin.
- 2007 Lockheed Martin Aeronautics Company Award for Excellence in Engineering Teaching
    - each year since 1956, Lockheed Martin and its predecessor, has sponsored an award for excellence in engineering teaching to reward one College of Engineering faculty member for exceptional teaching. This prestigious award is given to a faculty member dedicating time and energy in abundance to teaching undergraduate and graduate students. As a result, his or her work leaves a mark of excellence on the entire College of Engineering. Nominations for this award are made by The University of Texas at Austin engineering students and faculty. Final selection is made by a committee composed the five most recent faculty recipients of the award and the student presidents of the Student Engineering Council (SEC) and the Graduate Engineering Council (GEC).

Vita for Dean P. Neikirk:

Dean P. Neikirk was born in Oklahoma City, Oklahoma, on October 31, 1957. He received the B.S. degree (1979) in physics from Oklahoma State University, and the M.S. (1981) and Ph.D. (1984) degrees in applied physics from the California Institute of Technology. He joined the faculty of The University of Texas at Austin in 1984, and is currently a Professor in the Department of Electrical and Computer Engineering, holding the Cullen Trust for Higher Education Professorship in Engineering (No. 7). Dr. Neikirk developed the first monolithic, high resolution focal plane detector array for use at wavelengths between 0.1 mm and 1 mm, and in 1984 received the Marconi International Fellowship Young Scientist Award "for contributions to the development of millimeter wave integrated circuits especially in the area of detectors and imaging arrays." He has also been named a 1986 National Science Foundation Presidential Young Investigator.

Dr. Neikirk's current research interests concentrate on the fabrication and modeling of electromagnetic and micromachined sensors and actuators. His work also includes projects involving integrated circuit processing and the high frequency properties of transmission lines. His work concentrates on the use of advanced fabrication techniques, including silicon micromachining, for new device and sensor development. Dr. Neikirk developed the teaching laboratory for semiconductor device fabrication at The University of Texas at Austin, and is an active member of The University of Texas at Austin Microelectronics Research Center. Recently Dr. Neikirk's research project related to the development of

new chemical sensors (an "electronic taste" sensor) was selected for a commercialization venture between the University of Texas and LabNow, Inc. Dr. Neikirk has also served as the Graduate Advisor of the Department of Electrical and Computer Engineering at UT-Austin, an Associate Chairman of the ECE Department, the Chair of the UT-Austin Graduate Assembly, the Chair of the UT-Austin Faculty Council, the Secretary of the General Faculty at UT-Austin, and is currently Associate Dean of the University of Texas at Austin Graduate School.

Professional Societies:

Senior Member, Institute of Electrical and Electronics Engineers
- Associate Editor for Solid State and VLSI Electronics, **IEEE Transactions on Education** (March 1991- Oct. 1994)

Commercialization of Technology:

Two companies have been founded based on technology developed by Dr. Neikirk's research group. In both cases the technology was developed at The University of Texas at Austin and licensed to start-ups.

From a University of Texas news release:
Firm commercializing University of Texas technology rounds up $14 million venture capital investment (October 1, 2004)

AUSTIN, Texas—LabNow Inc. has received $14 million in first-round venture investment for its point-of-care diagnostic system from the Soros Group, Austin Ventures and other investors.

The money will be used to develop the company's technology and to launch its initial product, CD4Now™, a point-of-care diagnostic tool for HIV/AIDS patients.

The device, which is based on technology developed at The University of Texas at Austin, quickly and accurately analyzes complex fluids such as blood.

Patents

1. US Patent 5,080,870: "Sublimating and Cracking Apparatus," Jan. 14, 1992; Inventors: B. G. Streetman, T. J. Mattord, D. P. Neikirk

2. US Patent 5,408,107: "Semiconductor Device Having Multiple Current-Voltage Curves and Zero-Bias Memory," April 18, 1995;
Inventors: Dean P. Neikirk and Kiran Kumar Gullapalli

3. US Patent 6,589,779: "General signaling protocol for chemical receptors in immobilized matrices," July 8, 2003;
Inventors: McDevitt; John T.; Anslyn; Eric V.; Shear; Jason B.; Neikirk; Dean P.
Assignee: Board of Regents, The University of Texas System (Austin, TX)

4. US Patent 6,602,702: "Detection system based on an analyte reactive particle," August 5, 2003
Inventors: McDevitt; John T. (Austin, TX); Anslyn; Eric V. (Austin, TX); Shear; Jason B. (Austin, TX); Neikirk; Dean P. (Austin, TX)

Assignee: The University of Texas System (Austin, TX)

5. US Patent 6,649,403: "Method of preparing a sensor array," November 18, 2003
Inventors: McDevitt; John T. (Travis, TX); Anslyn; Eric V. (Austin, TX); Shear; Jason B. (Austin, TX); Neikirk; Dean P. (Travis, TX)
Assignee: Board of Regents, The University of Texas Systems (Austin, TX)

6. US Patent 6,680,206, "Sensor arrays for the measurement and identification of multiple analytes in solutions," January 20, 2004
Inventors: McDevitt; John T. (Travis, TX); Anslyn; Eric V. (Austin, TX); Shear; Jason B. (Austin, TX); Neikirk; Dean P. (Travis, TX)
Assignee: Board of Regents, The University of Texas Systems (Austin, TX)

7. US Patent 6,713,298, "Method and apparatus for the delivery of samples to a chemical sensor array, " March 30, 2004
Inventors: McDevitt; John T. (Travis, TX); Anslyn; Eric V. (Travis, TX); Shear; Jason B. (Travis, TX); Neikirk; Dean P. (Travis, TX)
Assignee: Board of Regents, The University of Texas System (Austin, TX)

8. US Patent 6,908,770, "Fluid based analysis of multiple analytes by a sensor array," June 21, 2005
Inventors: McDevitt; John T. (Austin, TX); Anslyn; Eric V. (Austin, TX); Shear; Jason B. (Austin, TX); Neikirk; Dean P. (Austin, TX)
Assignee: Board of Regents, The University of Texas System (Austin, TX)

9. US Patent 7,022,517, "Method and apparatus for the delivery of samples to a chemical sensor array," April 4, 2006, filed: July 14, 2000
Inventors: McDevitt; John T. (Austin, TX); Anslyn; Eric V. (Austin, TX); Shear; Jason B. (Austin, TX); Neikirk; Dean P. (Austin, TX); Borich; Damon V. (Austin, TX)
Assignee: Board of Regents, The University of Texas System (Austin, TX)

10. US Patent 7,316,899, "Portable sensor array system," January 8, 2008, filed: January 31, 2001
Inventors: McDevitt; John T. (Austin, TX); Anslyn; Eric V. (Austin, TX); Shear; Jason B. (Austin, TX); Neikirk; Dean P. (Austin, TX)
Assignee: Board of Regents, The University of Texas System (Austin, TX)

11. US Patent 7,491,552, "Fluid based analysis of multiple analytes by a sensor array," February 17, 2009, filed: January 20, 2005
Inventors: McDevitt; John T. (Austin, TX); Anslyn; Eric V. (Austin, TX); Shear; Jason B. (Austin, TX); Neikirk; Dean P. (Austin, TX)
Assignee: Board of Regents, The University of Texas System (Austin, TX)

12. United States Patent 7,651,868, "Method and system for the analysis of saliva using a sensor array," January 26, 2010, Filed: December 13, 2004

Inventors: McDevitt; John T. (Austin, TX), Anslyn; Eric V. (Austin, TX), Shear; Jason B. (Austin, TX), Neikirk; Dean P. (Austin, TX), Christodoulides; Nick J. (Austin, TX)
Assignee: The Board of Regents of The University of Texas System (Austin, TX)

13. United States Patent 8,101,431, "Integration of fluids and reagents into self-contained cartridges containing sensor elements and reagent delivery systems," January 24, 2012, Filed: December 22, 2004
Inventors: McDevitt; John T. (Austin, TX), Ballard; Karri L. (Pflugerville, TX), Floriano; Pierre N. (Austin, TX), Christodoulides; Nick J. (Austin, TX), Neikirk; Dean (Austin, TX), Anslyn; Eric (Austin, TX), Shear; Jason (Austin, TX)
Assignee: Board of Regents, The University of Texas System (Austin, TX)

14. United States Patent 8,105,849, "Integration of fluids and reagents into self-contained cartridges containing sensor elements," January 31, 2012, Filed: December 22, 2004
Inventors: McDevitt; John T. (Austin, TX), Ballard; Karri L. (Pflugerville, TX), Floriano; Pierre N. (Austin, TX), Christodoulides; Nick J. (Austin, TX), Neikirk; Dean (Austin, TX), Anslyn; Eric (Austin, TX), Shear; Jason (Austin, TX)
Assignee: Board of Regents, The University of Texas System (Austin, TX)

15. United States Patent 8,257,967, "Method and system for the detection of cardiac risk factors," September 4, 2012, Filed: April 28, 2003
Inventors: McDevitt; John T. (Austin, TX), Anslyn; Eric V. (Austin, TX), Shear; Jason B. (Austin, TX), Neikirk; Dean P. (Austin, TX), Christodoulides; Nick J. (Austin, TX)
Assignee: Board of Regents, The University of Texas System (Austin, TX)

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148. Joo-Yun Jung, Jong Yeon Park, Dean P. Neikirk, Aniruddha S. Weling, William T. Hafer, James H. Goldie, Paul D. Willson, "Skin depth effects in wavelength-selective infrared microbolometers based on lossy frequency selective surfaces," Proceedings of SPIE, Vol. 7660, Infrared Technology and Applications XXXVI, Orlando, Florida, Monday-Friday 5-9 April 2010, paper number 7660-38.

149. Jong Yeon Park, Joo-Yun Jung, Dean P. Neikirk, Aniruddha S. Weling, William T. Hafer, James H. Goldie, Paul D. Willson, "Fabrication of wavelength selective germanium dielectric supported microbolometers," Proceedings of SPIE, Vol. 7660, Infrared Technology and Applications XXXVI, Orlando, Florida, Monday-Friday 5-9 April 2010, paper number 7660-139.

150. Ali Abu Yousef, Praveenkumar Pasupathy, Sharon L. Wood, and Dean P. Neikirk, "Passive Sensors for Detecting Corrosion in Concrete Structures," 3rd Congress of the International Federation for Structural Concrete, Washington, DC, May 2010.

151. Ali Abu Yousef, Praveenkumar Pasupathy, Sharon L. Wood, and Dean P. Neikirk, "Passive Sensors for Detecting Corrosion in Concrete Structures," 5th International Conference on Bridge Maintenance, Safety and Management, Philadelphia, PA, July 2010.

152. Ali Abu Yousef, Praveenkumar Pasupathy, Sharon L. Wood, and Dean P. Neikirk, "Passive Sensors for Detecting Corrosion in Concrete Bridge Decks," 7th International Bridge Engineering Conference Improving Reliability and Safety - Restoration, Renewal and Replacement, San Antonio, Texas, December 2010.

153. JinYoung Kim, Praveenkumar Pasupathy, Chih-Chieh Chou, Sharon L. Wood, and Dean P. Neikirk, "Embedded passive wireless sensors for detecting conductivity within RC structures," Proc. SPIE 7983, 79832L (2011); doi:10.1117/12.880412, SPIE Conference on Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure, and Homeland Security 2011Monday 7 March 2011, San Diego, California.

154. Ali E. Abu-Yousef, Praveenkumar Pasupathy, Sharon L. Wood, and Dean P. Neikirk, "Low-Cost, Passive Sensors for Monitoring Corrosion in Concrete Structures," Proc. SPIE 7983, 79831Q (2011); doi:10.1117/12.879893, SPIE Conference on Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure, and Homeland Security 2011Monday 7 March 2011, San Diego, California.

155. P. Pasupathy, A. Abu Yousef, D. P. Neikirk, and S. L. Wood, "Wireless Electronic Structural Surveillance Sensors Using Inductively Coupled Sacrificial Transducers," Progress in Electromagnetics Research Symposium, PIERS 2011, Marrakesh. Morocco, March 20-23, 2011, PIERS Online Vol. 7 No. 6 2011 pp: 511-515

156. Ye Chen, Praveen Pasupathy, and Dean P. Neikirk, "The Effects of Defects on Magneto-inductive Waveguide," Progress in Electromagnetics Research Symposium, PIERS 2011, Marrakesh. Morocco, March 20-23, 2011, PIERS Online Vol. 7 No. 6 2011 pp: 506-510

157. Sheng P. Zhang, Praveenkumar Pasupathy, Dean P. Neikirk, "Microfabricated self-resonant structure as a passive wireless chemical sensor," Proc. SPIE 8066, 80661L

(2011); doi:10.1117/12.886895, SPIE International Symposium on Microtechnolgies, Conference 8066 Smart Sensors, Actuators and MEMS (EMT101), Prague, Czech Republic, 18-20 April 2011, Paper 8066-57.

158. Joo-Yun Jung, Jong Yeon Park, Dean P. Neikirk, Aniruddha S. Weling, Will Hafer, James H. Goldie, and Paul D. Willson, "Experimental LWIR spectral characterization of wavelength selective microbolometers," SPIE Defense, Security, and Sensing, Infrared Technology and Applications XXXVII Proceedings of SPIE, paper number 8012-38, 25-29 April 2011, Orlando, Florida.

159. Jong Yeon Park, James E. Gardner, Praveen Pasupathy, Ji Won Suk, Rodney S. Ruoff, and Dean P. Neikirk, "Fabrication and Characterization of Wavelength Selective Microbolometers using a Planar Self-aligned Process for Low Deformation Membranes," in MOEMS and Miniaturized Systems XI, part of SPIE MOEMS-MEMS, San Francisco, California, 25 Jan 2012, SPIE Paper Number 8252-33, Proc. SPIE 8252, 82520Y (2012); http://dx.doi.org/10.1117/12.906290 , 7 pages.

160. Ye Chen, Praveen Pasupathy, Tanuj Trivedi, Dean P. Neikirk and Sharon L. Wood, "Improved magneto-inductive waveguide as wireless sensor net for structural health monitoring," Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure, and Homeland Security 2012, San Diego, California, USA, Proc. SPIE 8347, 83472H (2012); http://dx.doi.org/10.1117/12.915227, Monday 12 March 2012, 8 pages.

161. Ali E. Abu-Yosef, Praveen Pasupathy, Sharon L. Wood and Dean P. Neikirk, "Detection of multiple corrosion thresholds in reinforced concrete structures using passive sensors," Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure, and Homeland Security 2012, San Diego, California, USA, Proc. SPIE 8347, 83470J (2012); http://dx.doi.org/10.1117/12.915164 , Monday 12 March 2012, 7 pages.

162. JinYoung Kim, Praveenkumar Pasupathy, Sharon L. Wood and Dean P. Neikirk, "Enhanced resolution of passive wireless conductivity sensors," Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2012, San Diego, California, USA, Proc. SPIE 8345, 83451B (2012); http://dx.doi.org/10.1117/12.916754 , Monday 12 March 2012, 7 pages.

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164. Hoo Kim and Dean P. Neikirk, "Three Dimensional Dual-band Stacked Microbolometer Design using resistive dipoles and slots," SPIE Infrared Technology and

Applications XXXIX, edited by Bjørn F. Andresen, Gabor F. Fulop, Charles M. Hanson, Paul R. Norton, Proc. of SPIE Vol. 8704, 870419, 11 June 2013.

165. Dean P. Neikirk, Hoo Kim, Jong Yeon Park, Joo-Yun Jung, “Patterned resistive sheets for use in infrared microbolometers,” SPIE Security + Defence, 25 Sep 2013 4:00 PM - 4:20 PM.

C. Published Abstracts

1. P.E. Young, Q.-X. Yu, W. A. Peebles, N.C. Luhmann, Jr., D. P. Neikirk, and D. B. Rutledge, "Application of Far-Infrared Imaging Arrays to Plasma Density and Magnetic Field Measurements," 4th APS Topical Conference on High Temperature, 1982.

2. P.E. Young, Q.-X. Yu, W.A. Peebles, N.C. Luhmann, Jr., D. P. Neikirk, and D. B. Rutledge, "Demonstration of Far-Infrared Phase Imaging," 24th Annual Meeting, Division of Plasma Physics, New Orleans, La., November, 1982.

3. P. E. Young, W.A. Peebles, N.C. Luhmann, Jr., R.J. Taylor, D. B. Rutledge, D. P. Neikirk, and P.P. Tong, "Current Profile Measurements in a Tokamak Plasma," 25th Ann. APS Meeting, Div. of Plasma Physics, Nov., 1983.

4. D. B. Rutledge, D. P. Neikirk, P.P. Tong, P.E. Young, W.A. Peebles, N.C. Luhmann, Jr., and R.J. Taylor, "Demonstration of a FIR Imaging System as a Multi-Channel Interferometer," 25th Ann. APS Meeting, Div. of Plasma Physics, Nov., 1983.

5. P.E. Young, N.C. Luhmann, Jr., R.J. Taylor, D. P. Neikirk, and D. B. Rutledge, 26th Annual Meeting of the Division of Plasma Physics, Boston, MA, Oct 29- Nov 2, 1984.

6. D.L. Brower, W.A. Peebles, S. Kim, R.L. Savage, Jr., T. Lehecka, N.C. Luhmann, Jr., J. Wagner, D. B. Rutledge, D. P. Neikirk, P.E. Young, and H.K. Park, "Recent advances in multichannel far-infrared collective scattering and interferometry systems," Eleventh Symposium on Fusion Engineering, Austin, TX, Nov. 18-22, 1985.

7. A.C. Campbell, V.P. Kesan, G.E. Crook, C.M. Maziar, D. P. Neikirk, and B. G. Streetman, "Capacitive Hysteresis Effects in 5.0nm single and double barrier AlAs Tunneling Structures," 8th Molecular Beam Epitaxy Workshop, Los Angeles CA, September 9-11, 1987.

8. A.C. Campbell, V.P. Kesan, G.E. Crook, D. P. Neikirk, and B. G. Streetman, "Capacitance Transient Analysis of GaAs/AlAs Tunneling Structures," 1988 Electronics Materials Conference, University of Colorado, Boulder, Colorado, June 22-24, 1988.

9. V.P. Kesan, A. Dodabalapur, D. P. Neikirk, and B. G. Streetman, "Influence of MBE Growth and Rapid Thermal Annealing Conditions on the Electrical Properties of Normal

and Inverted AlGaAs/InGaAs Pseudomorphic HEMT Structures," IEEE 46th Annual Device Research Conference, June 20-22, 1988, Boulder, CO.

10. A. Dodabalapur, V.P. Kesan, T.R. Block, D. P. Neikirk, and B. G. Streetman, "Optical and Electrical Characteristics of Normal and Inverted AlGaAs/InGaAs Pseudomorphic HEMT Structures Processed by RTA," 9th Molecular Beam Epitaxy Workshop, West Lafayette, Indiana, September 21-23, 1988.

11. A. Sharif, D. P. Neikirk, and D.R. Diller, "Design and Fabrication of a Multi-Sensor Cryomicroscope Stage using VLSI Technology," Cryo 89, Charleston, SC, June 1989, published in **Physics in Medicine and Biology 33.**

12. A. Dodabalapur, V.P. Kesan, D. P. Neikirk, B. G. Streetman, M.H. Herman, and I.D. Ward, "Photoluminescence and Electroreflectance Characterization of Modulation-Doped Quantum Wells," Journal of Electronic Materials 18, July 1989, p. 51.

13. V.K. Reddy and D. P. Neikirk, "Influence of Growth Interruption on I - V Characteristics of AlAs/GaAs Double Barrier Resonant Tunneling Diodes," 11th Annual Molecular Beam Epitaxy Workshop, Austin TX, Sept. 16-18, 1991.

14. A.J. Tsao, V.K. Reddy, D.R.Miller, K.K. Gullapalli, and D. P. Neikirk, "The effect of barrier thickness asymmetries on the electrical characteristics of AlAs/GaAs double barrier resonant tunneling diodes," 11th Annual Molecular Beam Epitaxy Workshop, Austin TX, Sept. 16-18 1991.

15. T.R. Block, D. P. Neikirk, and B. G. Streetman, "MBE growth condition dependence of RHEED dampening and QW photoluminescence," Twelfth North American Conference on Molecular Beam Epitaxy, Ottawa, Canada, Oct. 12-14, 1992.

16. T.J. Mattord, D. P. Neikirk, A. Srinivasan, A. Tang, K. Sadra, Y.C. Shih, and B. G. Streetman, "Real time flux monitoring and feedback control of a valved arsenic source" Twelfth North American Conference on Molecular Beam Epitaxy, Ottawa, Canada, Oct. 12-14, 1992.

17. Y.C. Shih, D. P. Neikirk, and B. G. Streetman, "Effects of As flux on Si δ-doped GaAs," Twelfth North American Conference on Molecular Beam Epitaxy, Ottawa, Canada, Oct. 12-14, 1992.

18. Y. Kim and D. P. Neikirk, "Monolithically integrated optically interrogated pressure microsensor," **J. Acoust. Soc. Am.**, Vol. 92, No. 4 (pt. 2), October 1992, p. 2353.

19. O. Hartin, D. P. Neikirk, A. Anselm, and B. Streetman, “Memory Switching Simulation in Resonant Tunneling Devices,” 1997 American Physical Society March Meeting, Kansas City, MO, March 17-21, Bulletin of the American Physical Society, Vol. 42, No. 1, 1997, p. 548.

20. O. Hartin and D. P. Neikirk, “Tight Binding Simulation of Memory Switching in

Resonant Tunneling Devices," 1997 American Physical Society International Conference on Computational Physics, University of California, Santa Cruz, Aug. 25, 1997.

21. D. Neikirk, "Embedded Passive Sensors for State Monitoring," presented at NSF Workshop on Exploring the Uses of Autoadaptive Media in Geotechnical Earthquake Engineering, Austin, TX, January 10-12 2001.

22. Lavigne, John J.; Savoy, Steve; Best, Michael; Anslyn, Eric V.; Shear, Jason B.; McDevitt, John T.; Neikirk, Dean, "Toward the development of an 'electronic tongue'," Book of Abstracts, 219th ACS National Meeting, San Francisco, CA, March 26-30, 2000 (2000), AGFD-193.

23. Wood, Sharon; Neikirk, Dean, "Development of a passive sensor to detect cracks in welded steel construction," US-Japan Joint Workshop and Third Grantees Meeting, US-Japan Cooperative Research in Urban Earthquake Disaster Mitigation, Monbu-Kgagku-sho and The National Science Foundation, Seattle, August 15-16, 2001.

24. McCleskey, Shawn C.; Goodey, Adrian P.; Rodriguez, Marc D.; McDevitt, John T.; Anslyn, Eric V.; Neikirk, Dean P., "Development of a multi-component sensor array for the simultaneous detection of various analytes in solution," Abstracts of Papers, 222nd ACS National Meeting, Chicago, IL, United States, August 26-30, 2001.

D. Other Major Publications

V. Kesan and D. P. Neikirk, "Quantum Well Devices," **Microwaves and RF**, vol. 25, July 1986, pp. 93-97.

D. P. Neikirk, P. Cheung, M.S. Islam, and T. Itoh, "Optically Controlled Coplanar Waveguide Phase Shifters," **Microwave Journal**, Dec. 1989, pp. 77-88.

D. P. Neikirk, "Quantum Wells and Other Deep Subjects," **Discovery**, Vol. 11, No. 3, 1989, pp. 5-8.

S. M. Wentworth, J. M. Lewis, and D. P. Neikirk, "Antenna-Coupled Thermal Detectors of mm-Wave Radiation," **Microwave Journal**, Jan. 1993, pp. 94-103.

E. Book Chapter

D. B. Rutledge, D. P. Neikirk, and D. Kasilingam "Integrated- Circuit Antennas," in **Infrared and Millimeter Waves**, vol. 11, editor K.J. Button, 1984.

Nicolaos Christodoulides, Priya Dharshan, Jorge Wong, Pierre N. Floriano, Dean Neikirk and John T. McDevitt, "A Microchip-Based Assay for Interleukin-6," In: Methods in

Molecular Biology, Volume 385: Microchip-Based Assay Systems, Humana Press, ISBN 978-1-58829-588-0 (Print) 978-1-59745-426-1 (Online), Copyright 2008, pages 131-144.

F. Technical Reports

C-K Tzuang, D. P. Neikirk, and T. Itoh, "Finite Element Analysis of Slow-Wave Schottky Contact Printed Lines," Microwave Laboratory Report No. 87-P-2, AFOSR Grant 86-0036, Feb., 1987.

D. P. Neikirk and T. Itoh, "Monolithic Phase Shifter Study," Microwave Laboratory Report No. 87-P-3, AFOSR Grant 86-0036, Jan., 1987.

V. P. Kesan and D. P. Neikirk, "Quantum Well Devices," Electrical Engineering Research Laboratory Report No. 87-P-8, Joint Services Electronics Program Research Contract AFOSR F49620-86-C-0045, August 7, 1987.

Stuart M. Wentworth and D. P. Neikirk, "High Frequency Characteristics of Tape Automated Bonding (TAB) Interconnects," Microwave Laboratory Report No. 87-P-7, August 26, 1987.

Stuart M. Wentworth and D. P. Neikirk, "Characterization of Tape Automated Bonding (TAB) Interconnects at High Frequency ," Microwave Laboratory Report No. 87-P-9, October 23, 1987.

D. P. Neikirk and T. Itoh, "Monolithic Phase Shifter Study," Microwave Laboratory Report No. 90-P-1, Final Technical Report for AFOSR Grant 86-0036, Feb., 1990.

A. Mortazawi, D. Neikirk, and T. Itoh, "Microwave and millimeter wave oscillators and planar power combining structures for QWITT and Gunn diodes," Microwave Laboratory Report No. 90-P-4, Technical Report for ARO Grant DAAL03-88-K-0005 and JSEP Grant F49620-89-0044, Aug., 1990.

<u>Oral Presentations</u>

A. Professional Society Presentation

D. B. Rutledge and D. P. Neikirk, "Imaging Antenna Arrays," Invited Keynote Speakers, Sixth International Conference on Infrared and Millimeter Waves, Miami. Fl., Dec. 7-12, 1981.

D. P. Neikirk and D. B. Rutledge, "Advances in Microbolometers," Invited Keynote Speakers, Eighth International Conference on Infrared and Millimeter Waves, Miami, Fl., Dec. 12-17, 1983.

D. P. Neikirk, "Optically Controlled Coplanar Waveguide Millimeter Wave Phase Shifter," Tenth International Conference on Infrared and Millimeter Waves, Lake Buena Vista, Fl., Dec. 9-13, 1985.

D. P. Neikirk, "Picosecond Response of an Optically Controlled Millimeterwave Phase Shifter," Second Topical Meeting on Picosecond Electronics and Optoelectronics, Jan., 1987.

D. P. Neikirk, "Influence of Transit Time Effects on the Optimum Design and Maximum Oscillation Frequency of Quantum Well Oscillators," 12th International Conference on Infrared and Millimeter Waves, Dec. 14-18, 1987.

D. P. Neikirk, "Measurements of an Optically Controlled Coplanar Waveguide Phase-Shifter," 12th International Conference on Infrared and Millimeter Waves, Dec. 14-18, 1987.

D. P. Neikirk, "High Frequency Characterization of Tape-Automated Bonding Interconnects," 5th Annual Texas Regional Symposium, International Society of Hybrid Manufacturing, April 11, 1988.

D. P. Neikirk, "Time Dependent Simulation of the Quantum Well Injection Transit Time Diode," 13th International Conference on Infrared and Millimeter Waves, Dec. 5-9, 1988.

D. P. Neikirk, "Experimental Performance of a Periodically Illuminated Optically Controlled Coplanar Waveguide Phase Shifter," 13th International Conference on Infrared and Millimeter Waves, Dec. 5-9, 1988.

B. Invited Lectures

1. D. P. Neikirk, "Exotic Heterojunction Devices for Microwave Circuits," NSF Workshop on Future Research Opportunities in Electromagnetics, Arlington, TX., January 29-31, 1986.

2. D. P. Neikirk, "Optical Control of a Monolithic Millimeter Phase Shifter," ARO Workshop on Fundamental Issues in Millimeter and Submillimeter Waves, Los Angeles, Ca., Sept. 15-16, 1986.

3. Dean P. Neikirk, "Quantum Well Oscillators for Millimeter Wave Applications," 1987 Workshop on Compound Semiconductor Microwave Materials and Devices (WOCSEMMAD), Hilton Head Island, S.C., March 2-4, 1987.

4. S.M. Wentworth and D. P. Neikirk, "High Frequency Tape-Automated Bonding (TAB) Interconnect Characterization," IEEE 6th Annual VLSI and GaAs Packaging Workshop, Sept. 14-16, 1987.

5. D. P. Neikirk, "The quantum well injection transit time diode," Engineering Foundation Conference on Advanced Heterostructure Transistors, Keauhou-Kona, Hawaii, Dec. 5-10, 1988.

6. D. P. Neikirk, ""The High Frequency Characteristics of Tape Automated Bonding (TAB) Interconnects," presented to the Microelectronics and Computer Technology Corporation, April 19, 1989.

7. Dean P. Neikirk, "Impedance measurements of quantum well diodes for millimeter wave applications," 1990 Workshop on Compound Semiconductor Microwave Materials and Devices (WOCSEMMAD), San Francisco, CA., Feb. 12-14, 1990.

8. Dean P. Neikirk, "Twin-slot multi-layer substrate-supported antennas and detectors for terahertz imaging," First International Symposium on Space Terahertz Technology, University of Michigan, Ann Arbor, Mich., March 5-6, 1990.

9. Dean P. Neikirk, "Microwave and Millimeterwave Oscillators using Quantum Well Diodes," Joint IEEE MTT/ED Dallas Chapter meeting, Sept. 27, 1990.

10. Dean P. Neikirk, "Quantum Transport Simulations of Resonant Tunneling Diodes," 1991 Workshop on Compound Semiconductor Microwave Materials and Devices (WOCSEMMAD), Ft. Lauderdale, FL., Feb. 18-20, 1991.

11. Dean P. Neikirk, “The Application of Physics in Electrical Engineering (or is it Engineering in Physics?): Electromagnetics in Very High Frequency Semiconductor Devices,” Physics Colloquium, Oklahoma State University, March 5, 1992.

12. D. P. Neikirk and B. G. Streetman, "MBE growth of multilayer heterostructures for photonic and high-speed electronic devices," Engineering Foundation Conference on High Speed Optoelectronic Devices and Circuits II, Banff, Alberta, Canada, Aug. 9-13, 1992.

13. L. T. Pillage, D. P. Neikirk, and R. Mercer, "Design automation techniques and algorithms for application specific electronic modules (ASEMs)," ARPA Electronic Packaging & Interconnect Principle Investigator Meeting, Marina del Ray, CA, Feb. 14-18, 1994.

14. D. P. Neikirk, "Micro-sensors - What happens when you make classical devices small?: Integrated Bolometric Radiation Detectors," Texas Instruments, Dallas, Texas, Oct. 20, 1994.

15. Dean P. Neikirk, "Micromachined sensors," Motorola Sensors Steering Committee, Albuquerque, New Mexico, March 28, 1995.

16. D. P. Neikirk, E. Tuncer, and B.-T. Lee, "The Use of Effective Internal Impedance Approximations in Lossy Transmission Line Modeling," *Progress in Electromagnetics Research Symposium PIERS 95*, The Universtity of Washington, Seattle, Washington, July 28, 1995.

17. D. P. Neikirk, M. S. Islam, and E. Tuncer, "Accurate Quasi-Static Modeling of Transmission Lines on Semiconducting Substrates," *Progress in Electromagnetics Research Symposium PIERS 95*, The Universtity of Washington, Seattle, Washington, July 28, 1995.

18. D. P. Neikirk, "Impact of Finite Metal Conductivity on Inductance Extraction of Interconnects and Packages," Sematech meeting on Electrical Modeling Challenges Faced by Packaging Designers, Austin, Texas, Nov. 19, 1995.

19. D. P. Neikirk, "Micromachined Fabry-Perot Pressure Transducers," Hughes Research Laboratory, Malibu, California, Nov. 21, 1995.

20. D. P. Neikirk, "Classical Devices Made Small; or 'What's the big deal about little machines?'", Manufacturing 2000, University of Texas at Austin, Feb. 23, 1996.

21. D. P. Neikirk, "Interconnect Inductance Modeling from DC to the Skin Effect Limit," Quad Designs, Camarillo, CA, July 10. 1996.

22. D. P. Neikirk, "Efficient Conductor Boundary Conditions in the dc to Skin Effect Limit," DARPA MAFET Program Review, Fairfax, VA, Oct. 27-31, 1997.

23. Micromachined Array-based Multi-analyte Chemical Sensors: Towards the Fabrication of an "Electronic Tongue" South, Texas Local Section of The Electrochemical Society Meeting, April 17, 1999.

24. D. P. Neikirk, "Resonant Chemical Surveillance Tags," IEEE Electron Device Chapter, Central Texas Section, September 25, 2008.

25. D.P. Neikirk, "Near Borehole Condition Sensing," Nanotechnology Conference and Trade Show - Nanotech 2009, Houston, TX May 3-7, 2009, Nanotech & Cleantech for Oil & Gas Session, (Session chair: Sean Murphy, Advanced Energy Consortium), May 5, 2009.

26. D.P. Neikirk, "Integrated Threshold Nanosensor Systems," Advanced Oil Consortium Microfabricated Sensors Workshop, Houston Research Center, Bureau of Economic Geology, University of Texas at Austin, September 8th-9th, 2010.

27. D. P. Neikirk, "Sensing systems for "harsh" environments," Engineering Challenges for Deepwater Drilling at the "U.S. Offshore Oil Exploration: Managing Risks to Move

Forward," James A. Baker III Institute for Public Policy and PFC Energy, Rice University, Houston, TX, February 11, 2011.

C. Other Conference Presentations

Praveen Pasupathy, Mingxiang Zhuzhou, Shasi K. Munukutla, Dean P. Neikirk, and Sharon L. Wood, "Resonant Wireless Sensor Nets for Civil Infrastructure Health Monitoring," 2009 National Science Foundation Division of Civil, Mechanical and Manufacturing Innovation (CMMI) Engineering Research and Innovation Conference, Honolulu, Hawaii, June 22-25, 2009.

Technical Consulting

Teltech Resource Network (1985-1993)
Ardex, Inc. (1986-88)
University and Polytechnic Grants Committee, Consultancy to examine Equipment Requirements for the Hong Kong University of Science and Technology, July, 1989
E. P. Hamilton Associates, (1987-90)
Burnett Company, Microwave Heating for Secondary Oil Recovery, July, 1990
Microelectronics and Computer Technology Corporation, June, 1990
Microelectronics and Computer Technology Corporation, Oct., 1994 - Sept., 1996
Baker-Hughes

University Committee Assignments

Departmental:

Graduate Student Financial Aid, Sept. 1984- Sept. 1987
Faculty Recruiting, Sept. 1984- Aug. 1985
Microelectronics Jr. Faculty Recruiting, Sept. 1985- Sept. 1987 (chairman)
ECE Safety Committee, Sept. 1985- Aug. 1993 (chairman, 1985-89)
ECE Electronics Shop Coordinating Committee, March 1986- Aug. 1993
Solid State Electronics Area Graduate Advisor, Aug. 1986- Aug. 89
ECE Space Allocation Committee, Sept. 1989-Aug. 1993 (chairman)
ECE Facilities Committee, Sept. 1993- Aug. 1996 (chairman)
ECE Areas Committee, Electromagnetics/Acoustics, Sept. 1993-present
ECE Ad Hoc Committee to Review the Undergraduate Curriculum, Jan. 1995- Aug. 1995
ECE World Wide Web Home Page Committee, Sept. 1995-Aug. 1996
ECE Ad Hoc Committee to Review the Undergraduate Curriculum, Jan. 1997- Aug. 1997
ECE Areas Committee, Materials and Quantum Electronics, Sept. 1993- present; chairman, Sept. 1996-present
Chair of ECE Graduate Studies Committee, May 1998-August 2006
ECE Chair's council, November 1999-2010
ECE Graduate Advisor, Sept. 1999- 2010
ECE Associate Chair, Sept. 2001-Dec. 2010
ECE peer Faculty Annual Review Committee, Sept. 2012-Aug. 2013

College:

Engineering Scholastic Appeals, Sept. 1984- Aug. 1985
Engineering Safety Committee, Sept. 1985- Aug. 1994 (chairman, Sept. 1989- Aug. 1994)

Aerospace Engineering Machine Shop, Sept. 1989-Aug. 1993
College Annual Report Quality Team, Jan. 1994- Aug. 1994
College Multimedia Committee, Sept. 1995-Aug. 2000
Equal Opportunity in Engineering (EOE) Program, 1995-Dec. 1996
Graduate Fellowship Review Committee, Sept. 2011-Aug. 2013

University:

Presidential Ad Hoc Committee on Research Infrastructure Enhancement, Jan. 1988 - Aug. 1994
Research Safety Advisory Committee, Oct. 1991-present (chairman, Sept. 1996-1999)
Ad Hoc Consultative Committee for the Selection of a Dean of the College of Engineering, Nov. 1995-May 1996
Faculty Building Advisory Committee, Sept. 1995-Aug. 2000; Aug. 2003-Aug. 2004
Ad Hoc Project Committee for Parking Garage # 4A, Sept. 1996-Aug. 2000
Faculty Council, Sept. 1996-Aug. 2000; Sept. 2002 - Aug. 2004
Faculty Advisory Committee on the Budget, Sept. 99 - Aug. 2000; Sept. 2008 – Aug. 2011 (vice chair Sept. 2009- Aug. 2010)
Graduate Assembly, April 1997- Aug. 2000; Sept. 2001 - Aug. 2008
Administrative sub-committee of GA, Sept. 1997-Aug. 1998; Sept. 2006-Aug. 2007
Academic sub-committee of GA, Sept. 1998-Aug. 2000; Sept. 2001-Aug. 2006; Sept. 2007-Aug. 2008
Chair, Graduate Assembly, 2004-2005
Academy of Distinguished Teachers selection committee, academic year 1999-2000
Outstanding Graduate Adviser selection committee, academic year 1999-2000
Outstanding Graduate Coordinator selection committee, academic year 1999-2000
Faculty Council, Sept. 2008 – Aug. 2012; Chair-elect Sept. 2009- Aug. 2010; Chair Sept. 2010- Aug. 2011; past chair: Sept. 2011-Aug. 2012
Faculty Council Executive Committee, Sept. 2009 – Aug. 2012
General Faculty Rules and Governance Committee, Sept. 2010 – Aug. 2015 (Chair, Sept. 2011 – Aug. 2013)
Ad Hoc Consultative Committee for the Selection of a Dean of the Graduate School, Nov. 2012 – Sept. 2012
Secretary of the General Faculty and Faculty Council, Sept. 2013 – Aug. 2015
Committee on Undergraduate Degree Program review, Sept. 2013 – Aug. 2015
Faculty Council Executive Committee, Sept. 2013 – Aug. 2015
Faculty Committee on Committees, *ex officio* member, Sept. 2013 – Aug. 2015

UT System:

Task Force on Doctoral Programs and Post-Doctoral Experience, Spring-Fall 2006
University of Texas System Faculty Advisory Council, Sept. 2009- Aug. 2011

State of Texas:
Texas Higher Education Coordinating Board Graduate Education Advisory Committee (GEAC), September 1, 2015 - August 31, 2018.

<u>Evidence of Teaching Effectiveness</u>

Senior Design Projects:
Umer Yousafzai and Venuka Jayatilaka, Spring 1994
Chris Eiting and Sonny Gonzalez, Spring 1994
David Lee and David Onsongo, Fall 1996
Dave Pyle and Aruna Murthy, Spring 1999
Hitesh Mehta and Edward Zhu, Spring 1999, "Giving the electronic tongue a sense of good taste: image analysis tools and GUI"
Gus Espinosa and Donnie Garcia, Spring 1999, "Design and Implementation of a Computer Interfacing Circuit to Control LED's for use with a Chemical Sensor"
Natthanant Pon Skulkaew and Prem Nainani, Spring 2001, "PC-based data acquisition and wireless transmission system"
Matthew Andringa and Allen Hall, Spring 2001, "Non-Invasive RFID Weld Inspection"
Michael Amalfitano and Sapun Parekh, Spring 2002, "Output circuitry for a transmitter used in an Electronic Structural Surveillance system"
Kunal Patel and Jacy Little, Spring 2002, "Swept, high frequency oscillator to work in an Electronic Structural Surveillance (ESS) system"
Dong Pak, Spring 2002, "Automated image-processing software of an electronic chemical sensor"
Rajesh Nerlikar, Jonathan Solomon, Spring 2003, "Wireless Data Acquisition System for Bluetooth-enabled RFID Readers"
Nola Li, Judith Chen, Maria Huang, Fall 2003, "Design and build a tuning network for a swept frequency reader used in structural health analysis"
Tuenlap (Daniel) Chan, Imranul Islam, Derek Choi, Spring 2004, "Design and build an RFID Interrogator Receiver"
John McKee and Terence Man, Spring 2007, "Improved Corrosion Sensors"
Abdulaziz Beayeyz , Sravan Bhagavatula, Rahul Mitra, Shasi Munukutla, Spyder Spann, Fall 2009, "Portable Corrosion Detector"
Jonathan Pham, Po-Han Wu, Josh Schulte, Pritesh Solanki, Mesele Bedasa, Spring 2011- Fall 2011, "Multi-Sensor Robotics Platform"
Raymund Lee, Simon Chow, Connor Landy, Kevin Woo, and Anirudh Kashyap, Fall 2012-Spring 2013, "Variable Frequency RFID Tag and Reader"
Javier Chacon, Joshua Poncik, Joshua Orozco, Sebastian Salomon, Yongcong Zou, Fall 2013-Spring 2014, "Environmental Sensor Monitoring Network"

Organized Classes Taught:

EE 363M Introduction to Microwaves, Spring 1984, # 16455
EE 396K VLSI Fabrication Techniques, Fall 1984, # 16255
EE 379K Integrated Circuit Fabrication, Spring 1985, # 16055
EE 396K VLSI Fabrication Techniques, Fall 1985, # 16275
EE 379K Integrated Circuit Fabrication, Fall 1985, # 16070
EE 396K VLSI Fabrication Techniques, Spring 1986, # 17680
EE 379K Integrated Circuit Fabrication, Spring 1986, # 17450
EE 396K VLSI Fabrication Techniques, Fall 1986, # 15245
EE 379K Integrated Circuit Fabrication, Fall 1986, # 15020
EE 396K VLSI Fabrication Techniques, Spring 1987, # 15205
EE 379K Integrated Circuit Fabrication, Spring 1987, # 14970
EE 396K VLSI Fabrication Techniques, Fall 1987, # 15010
EE 440 Integrated Circuit Fabrication, Fall 1987, # 14545
EE 363M Introduction to Microwaves, Spring 1988, # 14535
EE 396K VLSI Fabrication Techniques, Spring 1988, # 14865
EE 440 Integrated Circuit Fabrication, Spring 1988, # 14390
EE 396K VLSI Fabrication Techniques, Fall 1988, # 15165
EE 440 Integrated Circuit Fabrication, Fall 1988, # 14705
EE 363M Introduction to Microwaves, Spring 1989, # 14525
EE 396K VLSI Fabrication Techniques, Spring 1989, # 14855
EE 396K VLSI Fabrication Techniques, Fall 1989, # 15165
EE 440 Integrated Circuit Fabrication, Fall 1989, # 14705
EE 363M Introduction to Microwaves, Spring 1990, # 14050
EE 396K VLSI Fabrication Techniques, Spring 1990, # 14355, 14360
EE 440 Integrated Circuit Fabrication, Spring 1990, # 13915, 13920
EE 396K VLSI Fabrication Techniques, Fall 1990, # 14630, 14635
EE 440 Integrated Circuit Fabrication, Fall 1990, # 14200, 14205
EE 363M Introduction to Microwaves, Spring 1991, # 14365
EE 396K VLSI Fabrication Techniques, Spring 1991, # 14660, 14665, 14670
EE 440 Integrated Circuit Fabrication, Spring 1991, # 14220, 14225, 14230
EE 396K VLSI Fabrication Techniques, Fall 1991, # 14865, 14860
EE 440 Integrated Circuit Fabrication, Fall 1991, # 14425, 14430
EE 363M Introduction to Microwaves, Spring 1992, # 14270
EE 396K VLSI Fabrication Techniques, Spring 1992, # 14545, 14550, 14555
EE 440 Integrated Circuit Fabrication, Spring 1992, # 14130, 14135
EE 396K VLSI Fabrication Techniques, Fall 1992, # 15095, 15100, 15105
EE 440 Integrated Circuit Fabrication, Fall 1992, # 14670, 14675
EE 397K Microwave Devices, Spring 1993, # 14805
EE 396K VLSI Fabrication Techniques, Fall 1993, # 14800, 14805, 14810
EE 440 Integrated Circuit Fabrication, Fall 1993, # 14385, 14390
EE 363M Introduction to Microwaves, Spring 1994, # 14370
EE 396K VLSI Fabrication Techniques, Fall 1994, # 14365

EE 440 Integrated Circuit Fabrication, Fall 1994, # 13870
EE 397K Electromagnetics in Packaging, Spring 1995, # 14555
EE 396K VLSI Fabrication Techniques, Fall 1995, # 14765
EE 440 Integrated Circuit Fabrication, Fall 1995, # 14260
EE 397K Electromagnetics in Packaging, Spring 1996, # 14695
EE 382M Simulation Methods in CAD/VLSI, Spring 1996, # 14500
EE 396K VLSI Fabrication Techniques, Fall 1996, # 14535
EE 440 Integrated Circuit Fabrication, Fall 1996, # 14090
EE 382M Simulation Methods in CAD/VLSI, Spring 1997, # 14325
EE 363M Introduction to Microwaves, Spring 1997, # 14120
EE 396K VLSI Fabrication Techniques, Fall 1997, # 15315
EE 440 Integrated Circuit Fabrication, Fall 1997, # 14820
EE 363M Introduction to Microwaves, Spring 1998, # 14530
EE 397K Microwave Devices, Spring 1998, # 14950
EE 396K VLSI Fabrication Techniques, Fall 1998, # 15475
EE 440 Integrated Circuit Fabrication, Fall 1998, # 14965
EE 363M Introduction to Microwaves, Spring 1999, # 14825
EE 397K Microwave Devices, Spring 1999, # 15260
EE 396K VLSI Fabrication Techniques, Fall 1999, # 15340
EE 440 Integrated Circuit Fabrication, Fall 1999, # 14820
EE 363M Introduction to Microwaves, Spring 2000, # 14755
EE 396K VLSI Fabrication Techniques, Fall 2000, # 15600
EE 440 Integrated Circuit Fabrication, Fall 2000, # 15100
EE 397K Micro-electromechanical Systems (MEMS), Spring 2001, #15170
EE 396K VLSI Fabrication Techniques, Fall 2001, # 15725
EE 440 Integrated Circuit Fabrication, Fall 2001, # 15230
EE 397K Micro-electromechanical Systems (MEMS), Spring 2002, #15330
EE 396K VLSI Fabrication Techniques, Fall 2002, # 16050
EE 440 Integrated Circuit Fabrication, Fall 2002, # 15485
EE 397K Microwave Devices, Spring 2003, # 15110
EE 396K VLSI Fabrication Techniques, Fall 2003, # 15580
EE 440 Integrated Circuit Fabrication, Fall 2003, # 15095
EE 325 Electromagnetic Engineering, Spring 2004, # 14345
EE 396K VLSI Fabrication Techniques, Fall 2004, # 16250
EE 440 Integrated Circuit Fabrication, Fall 2004, # 15715
EE 396K 26-Microelectromechanical Systems, Spring 2005, # 15690
EE 396K VLSI Fabrication Techniques, Fall 2005, # 16455
EE 440 Integrated Circuit Fabrication, Fall 2005, # 15930
EE 396K VLSI Fabrication Techniques, Fall 2006, # 17040
EE 440 Integrated Circuit Fabrication, Fall 2006, # 16430
EE 325 Electromagnetic Engineering, Spring 2007, # 15765
EE 396K VLSI Fabrication Techniques, Fall 2007, # 17425
EE 440 Integrated Circuit Fabrication, Fall 2007, # 16770
EE 396K-26 Microelectromechanical Systems, Spring 2008, # 16815
EE 396K VLSI Fabrication Techniques, Fall 2008, # 17380
EE 325 Electromagnetic Engineering, Spring 2009, # 16000

EE 396K-24 Microwave Devices, Spring 2010, # 16975
EE 396K VLSI Fabrication Techniques, Fall 2010, # 17075, 17080, 17085, 17090
EE 440 Integrated Circuit Fabrication, Fall 2010, # 16540, 16545, 16550, 16555
EE 396K VLSI Fabrication Techniques, Fall 2011, # 17295, 17300, 17305, 17310
EE 440 Integrated Circuit Fabrication, Fall 2011# 16760, 16765, 16770, 16775
EE 396K 26-Microelectromechanical Systems, Spring 2012, #17070
EE 396K VLSI Fabrication Techniques, Fall 2012, # 17185, 17190, 17195, 17200
EE 440 Integrated Circuit Fabrication, Fall 2012, # 16640, 16645, 16650, 16665
EE 363M Introduction to Microwaves, Spring 2013, # 16605
EE 396K Ultra Large Scale Integrated Circuit Fabrication Techniques, Fall 2013, # 17425, 17430, 17435, 17440
EE 440 Integrated Circuit Nanomanufacturing Techniques, Fall 2013, # 16790, 16795, 16800, 16805
EE 396K-24 Microwave Devices. Spring 2014, #17440
EE 396K Ultra Large Scale Integrated Circuit Fabrication Techniques, Fall 2014, #17525, 17530, 17535, 17540
EE 440 Integrated Circuit Nanomanufacturing Techniques, Fall 2014, #16960, 16965, 16970, 16975
EE 363M Microwave and Radio Frequency Engineering, Spring 2015, #16355
EE 396K Ultra Large Scale Integrated Circuit Fabrication Techniques, Fall 2015, #16965, 16970, 16975
EE 440 Integrated Circuit Nanomanufacturing Techniques, Fall 2015, #16480, 16485, 16490
EE 363M Microwave and Radio Frequency Engineering, Spring 2016, #16550

Continuing Education Courses Taught

"Microelectronics Fabrication - Chemical Aspects," with Isaac Trachtenberg, Continuing Engineering Studies, College of Engineering, The University of Texas at Austin, June 1-4, 1987.

"Integrated Circuit Process & Design," with M. R. Mercer, Motorola short course, Continuing Engineering Studies, College of Engineering, The University of Texas at Austin:

- Aug.-Sept., 1987
- Nov.-Dec., 1987
- Nov.-Dec., 1988
- March-April, 1989
- Aug.-Sept., 1989
- Nov.-Dec., 1989

- Feb.-March, 1990
- April, 1990
- Aug., 1990

"Integrated Circuit Processing and Design," with L. T. Pillage, Advanced Micro Devices short course, Continuing Engineering Studies, College of Engineering, The University of Texas at Austin:

- Oct.-Nov., 1990
- June-July, 1991

"Microelectronics Fabrication," for the Fellows of the Senior Service College Fellowship Program, Continuing Engineering Studies, College of Engineering, The University of Texas at Austin, yearly 1993-2003.

Advising and Student Service

Solid State Electronics Area Graduate Advisor, Aug. 1986- Aug. 89
Engineering Freshman Faculty Mentor, 1993-1996
Engineering Peer Support (EPS) Program Faculty Mentor, 1995, 1996
Equal Opportunity in Engineering (EOE) Program, WOE organizer, 1995, 1996